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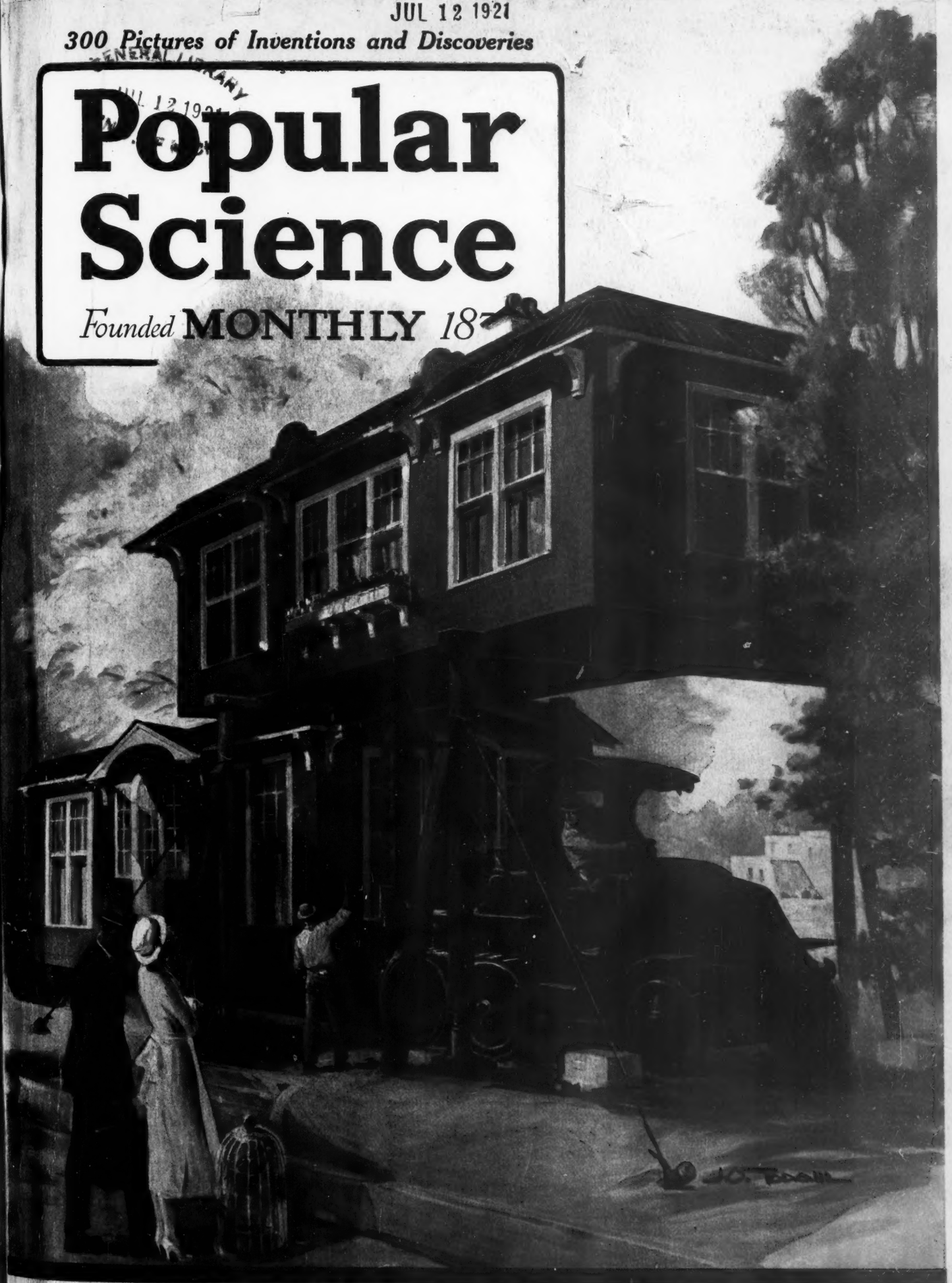

Factory-Built House of Concrete Delivered for $1500—See page 15

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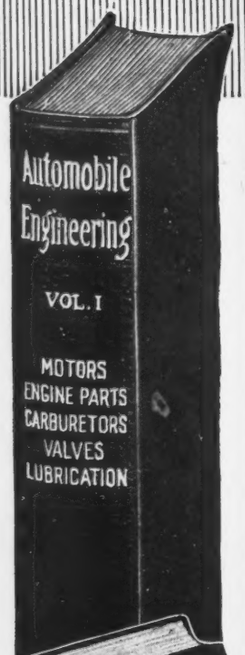

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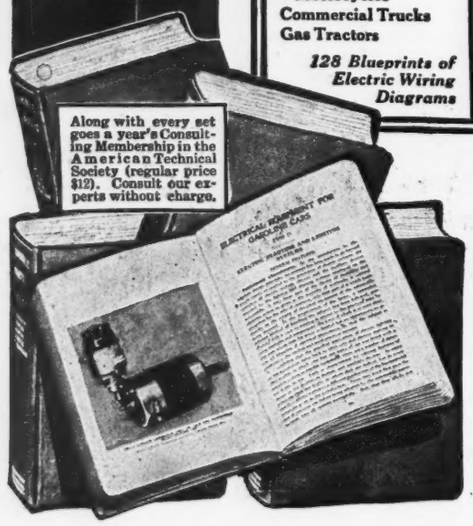

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Popular Science Monthly

August, 1921; Volume 99, No. 2
25 Cents a Copy; $3 a Year

Published in New York City at
225 West Thirty-ninth Street

Complete House Delivered by Truck for $1500

A project to break the housing deadlock

By Simon Lake

ARE you to-day, like millions of other Americans, longing for a home of your own? Are prohibitive building costs keeping you a slave to your landlord and to an excessive monthly rent? Approximately 7,000,000 families in this country own their own homes. It is estimated that, out of a total of 23,000,000 families in the country, at least another 7,000,000 hope to own a house when building conditions permit. There are about a million marriages performed annually in the United States. With an already existing shortage of some 1,500,000 homes, where are the dwellings for these new families to come from?

Relief at Hand?

I believe that partial relief can be brought at once to many of you who are suffering from these conditions, by factory production of complete, low-cost concrete homes, to be delivered to you by motor-truck.

Our shoes, watches, toothbrushes, hammers, hats, saws—all are factory-made, all made by machinery. By quantity production the cost is decreased to a fraction of the cost of the handmade product. Imagine what you would have to pay for a handmade toothbrush! Perhaps the contrast is the greatest in the case of pins. Before the introduction of machinery a single workman unaided could make only a few pins a day; the daily product of a workman is now about 15,000,000 pins a day, complete and stuck in papers.

Our Ancient Methods

But in building houses the process we use is that of the times of Julius Caesar and of William the Conqueror. Each house is built separately, just as formerly each pin was manufactured separately.

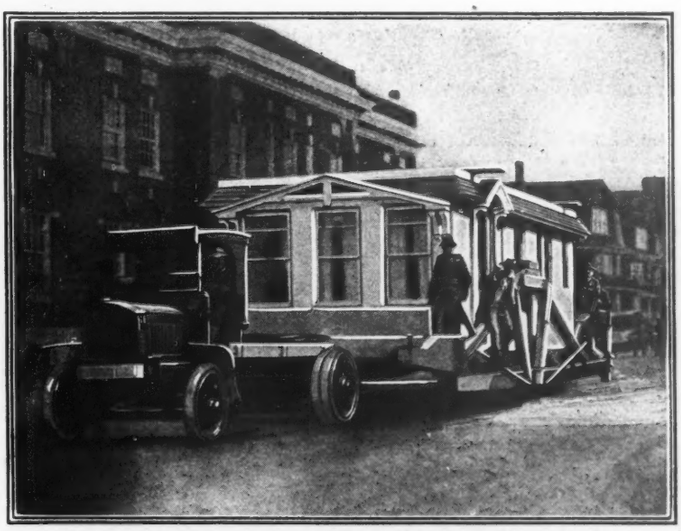
Logically our vitally needed new homes should come from the same place as shoes and stockings and chinaware and linens and canned goods—from factories. Such a factory is in operation to-day near Bridgeport, Connecticut. It is planned to erect others in seven or eight strategic points throughout the country. Of course these plants alone would not be able to

"Buy your building-plot now, while land values are low, telephone for a $1500 house, and move into your own home next day!"

This is the advice of Simon Lake, distinguished engineer and inventor of submarines. And he has backed up his advice by the actual production, in a factory at Bridgeport, Connecticut, of concrete houses to be delivered complete to the purchaser by motor-truck.

Ten factories of this kind in various parts of the country, each making motor-truck deliveries in an area of 7500 square miles, could produce 125,000 houses a year.

The Popular Science Monthly is planning to publish in an early issue a supplementary article covering other remarkable types of complete factory-built houses now in the market.



Specially designed motor-truck delivering through the streets of Bridgeport one of the completely equipped concrete houses built in Simon Lake's factory. These trucks will deliver houses a distance of fifty miles

Here's a whole row of ready-made houses. Observe that they do not look any more like one another than any row of city houses built at one time

solve the housing shortage. But, working at capacity, they might alleviate much of it.

These factories will make permanent, damp-proof, vermin-proof, very nearly heat-proof and cold-proof houses, constructed of monolithic reinforced concrete. They are factory-made, with all that this means in economy and speed; yet they can be adapted to your individual taste. These houses, which will be delivered to your door by motor-truck, are so cheap that any man with a moderate weekly income ought to be able to finance the purchase of one.

What You Can Get for $1500

For instance, our unit home costs $1500. It contains a combination living- and dining-room 12 by 12 feet; a kitchen 8 by 5 feet; a bedroom 12 by 8 feet; a bath 5 by 4 feet; and a sun-parlor, closets, and dressing-rooms as well.

In these homes we are introducing three absolutely new features:

First—A radical innovation in the *manufacture* of homes.

Second—An ingenious means of *delivering* them.

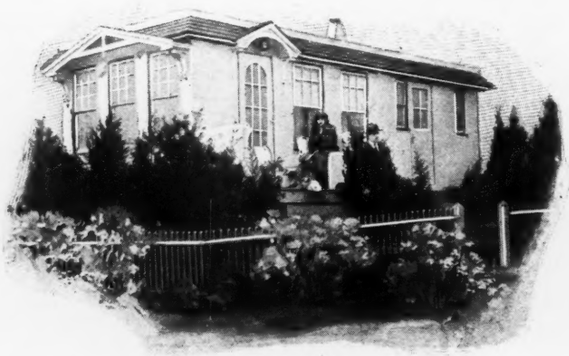
Third—A unique *design* for them.

The houses are constructed of the commonest of materials, sand and gravel, cast over galvanized steel reinforcements. The materials are brought into the plant on railroad cars and are then lifted by a grab-bucket into two huge hoppers, placed upon an enormous movable crane, which is the most important piece of apparatus in the plant. The cement is mixed and then flows into the forms. There are two strong forms made up of heavy steel girders and timbers to resist the pressure due to the weight of the semi-liquid concrete. Within these are placed sheet-iron cores internally braced to resist pressure. These cores render the walls of the new house hollow. The concrete fills all spaces between the cores and the outer forms. Hollow walls mean a house cool in summer and warm in winter.

Since the house is poured in one solid concrete unit, it is virtually indestructible. Before the cores are placed in position they are put through a bath of asphalt, and a coating about one eighth of an inch thick forms on them.

This serves a double purpose: first, it makes a coating on the inner lining of the walls and results in this concrete house being water-proof and damp-proof. Second, after the concrete gets its initial "set," air heated to 180 degrees is circulated through the cores, and this, melting the asphalt that remains on them, facilitates their withdrawal. Usually this would be a matter of days, but the warm air sent through the cores completes this process within three hours.

The crane then lifts the house and deposits it in another part of the yard, where it stands for two weeks to permit the cement to harden. The house, or house-unit, is then ready for delivery; for in the meantime the roof, the plumbing, the electric wiring, and all the other interior fittings have been added.



This five-room bungalow was made in a factory. It is a one-unit house, and contains a combination living- and dining-room, a kitchen, a bedroom, bath, sun-parlor, closets, and dressing-rooms. It cost $1500

But how do we keep these homes from bearing the stamp "factory-made"—from being as much alike as peas in a pod? The exterior of the building may be altered in any way to suit the owner. Friezes and frescoes may be added; roofs can be varied in many different ways. Tile or shingle may be superimposed upon the slab of reinforced concrete that is the real roof and that will never leak or decay. While the concrete is still moist, paint or liquid dyes will be sprayed upon it—any shade you desire—and a century from now the color will be as clear and fresh as when the house is delivered to you.

To deliver these houses I have designed a specially constructed ten-wheel steel truck with a low hung steel drop frame on which a house can be placed and delivered within a fifty-mile radius of the plant. A house can actually be put in place and made ready for occupancy on the very evening of the day on which it leaves the plant.

The Second Story Is Delivered First!

A cellar is not essential for these houses. The floors are cold-proof and damp-proof. Coal may be kept in a utility building at the side or in a special bin concealed on the roof, from which it may be let down to the stove by turning a lever. The house may be placed either on a cellar, on piers, or on a solid wall. So it is a comparatively simple matter, with the aid of the elevating apparatus carried by each truck, to put the house into its proper position.

When the residence is to be of two stories, the second story is delivered first, elevated to the proper height, and then propped in position on special struts until the first-story unit is brought, when the second story is lowered upon it.

Robert C. Lafferty, the originator of these houses, started with the idea that in the ordinary house there is too much waste space. The dining-room is used only a few hours a day; the bedrooms are not employed at all in the daytime. Accordingly, he had designed a home unit measuring only 28 feet 6 inches by 12 feet 6 inches, in which every cubic foot does duty for the greater part of the twenty-four hours.

In the daytime our house unit is a bungalow with a living-room, glassed-in sun-porch, a kitchen equipped with twentieth-century labor-saving devices, a den where a man can be alone with his pipe and a book, and two dressing-rooms with plenty of space for

chiffonnier, dressing-table, etc.

When mealtime comes the housewife detaches a mirror from the living-room wall. This lets down and forms a comfortable dining-room table for six. A revolving service connects the table with the kitchen and brings dinner to the table; when the meal is finished, it takes the empty dishes back to the kitchen. The mirror snaps back into place and you have a living-room again.

Where the Beds Go in the Daytime

When it is time to retire, a touch on a small rope pulley that hangs beside the window of the den brings down a bed from a paneled space in the ceiling. On the sun-porch is a similar bed.

The base cost of one unit such as I have described is $1500. This includes delivery, the kitchen sink and the necessary plumbing, linoleum, etc., beds and other fixtures, but not the bathroom fixtures or the plumbing that goes with them. As ornamental roofs or other extras are added, naturally the prices increase.

Two or more units are employed in conjunction where a larger house is required. Thus two units, divided into six rooms, cost $3000; three units, making an ample home for a family of moderate means, cost $4500, and six units, composing a larger dwelling with many luxuries, $6000.

The cost of these houses is about 50 cents a cubic foot, as compared with a cost of 40 cents for a cheap frame house up to 70 cents for one of stone and wood. But these houses will last forever, with almost no upkeep expense. I believe that this new house-building method is the method of today and of the future, and that, just as the great majority of the men who read this article go to a shoe-store for their shoes and to a men's-furnishing store for their shirts, more and more families will want the economy and beauty that come with homes exactly and scientifically constructed under conditions that make it possible to give maximum value for the dollar.

Facts about the Unit House

THE single-unit house may be placed on six concrete piers. The specially treated hollow concrete floor obviates the necessity of any further protection from dampness.

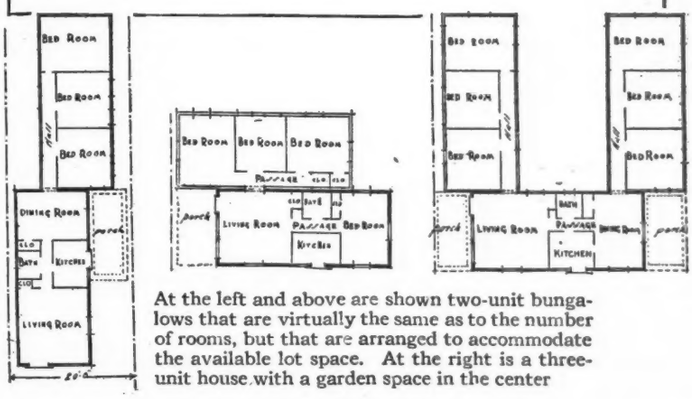
The new concrete house is fireproof and sunproof. No repainting is required.

Some of the furniture is built in and this reduces the furniture bill.

The house is warm in the winter and cool in the summer. Its hollow-wall construction makes it like a vacuum bottle.

A small efficient heating-plant is supplied with coal from a small coalbin that may be filled from the roof. The coal feeds down by gravity.

A turntable is used to serve the dining-room table direct from the kitchen.



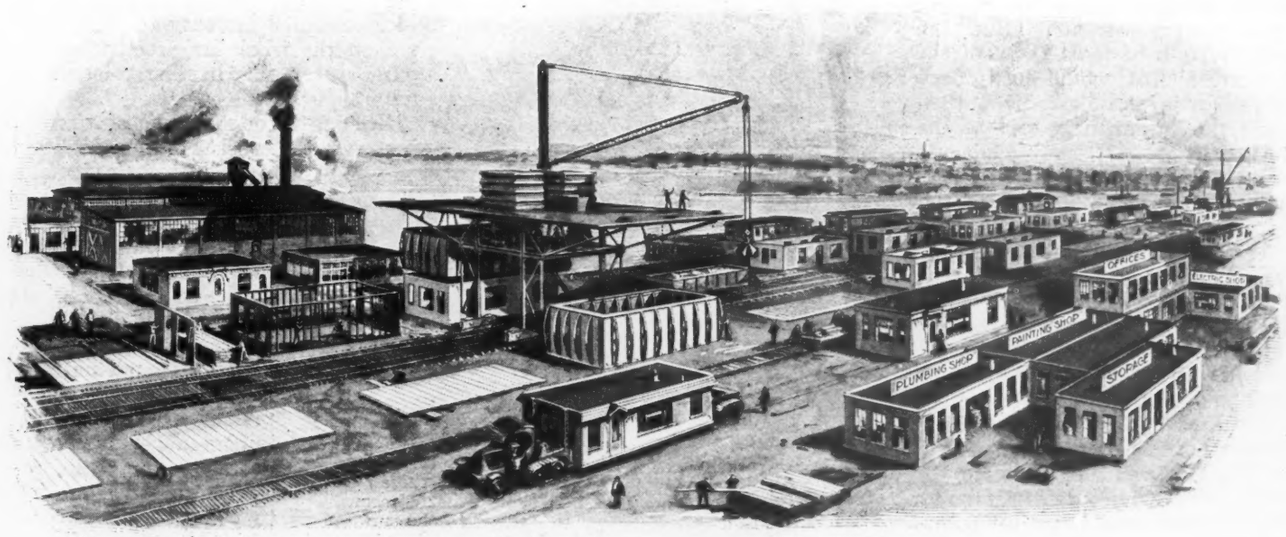
At the left and above are shown two-unit bungalows that are virtually the same as to the number of rooms, but that are arranged to accommodate the available lot space. At the right is a three-unit house with a garden space in the center

Saved—$4200 on One House Alone

Only recently a man came to us with a builder's bid of $10,500 for a frame house; we arranged a better, permanent home for him at a cost of but $6300. The method can also be used for the construction of two-family homes, apartment-houses and factories.

More and more I am convinced that I spoke the truth when, while our plans were getting under way, I wrote to Mr. Lafferty:

"I am beginning to think we really have introduced something new into the art of building construction."



Bridgeport, Connecticut, boasts the first factory where ready-made concrete houses are made. The factory buildings were also made on the unit plan. Several houses can be seen in process of manufacture. It will also be noticed that some of the skeleton houses are used as offices

Giving the Times Building a sponge bath. The walls of the building were painted with an acid solution, after which they were sponged with clean water

Spring-Cleaning a Skyscraper

FIFTEEN years ago the creamy white terra-cotta walls of the lofty Times Building in New York city were new and clean. Gradually they became gray and dull, and in the spring of this year it was decided to have them cleaned at a cost of about six thousand dollars. It took twelve men two months to do the work. Six scaffolds were required, two men working on each scaffold.

The old way to clean the stone walls of a building was to blow grains of sand upon the surface with compressed air. But the beautiful glazed terra cotta of the Times Building would have been spoiled by a sand-blast. How then could the workmen get rid of the coating of grime? They made use of an acid solution prepared especially by the manufacturers of the terra cotta in the walls.

The solution is applied by means of a painter's brush. A few minutes later it is sponged off with clean rinsing water. So small an amount of liquid is necessary in this process that it was not found necessary to erect an overhead canopy to protect pedestrians on the sidewalk below.

New York has more than eighty buildings of twenty or more stories. From an architectural standpoint they are the most beautiful buildings of their kind in the world, and it is the pride of the city that they should be kept white and clean.

Sixty Miles an Hour in a "Wind-Boat"

THE idea of driving a boat with an air-propeller is not new by any means, but this particular boat illustrated below has many original features that make it stand out from any of the other boats that have been developed along these lines.

The weight of the upper works is supported by two special metal pontoons.

The displacement of these is amply sufficient to support not only the weight of the engine, but it will also carry four passengers with perfect safety.

An aviation type of engine is used, and the propeller is connected directly with the crankshaft. This is the really unique feature about the boat as it is the first time it has been done on boats of this kind. The propeller is usually connected with the crankshaft by means of a heavy chain.

The motor is rated at one hundred and fifty horsepower. A water-screen or apron is placed at the stern of the craft to prevent the propeller from getting wet when the water splashes while the craft is running at high speed.

Mr. Allen H. Loughead, of Santa Barbara, California, who owns this "wind-boat," claims that it can attain a speed of sixty miles an hour.

© International Film Service

Though the idea of an air-propeller on a boat is not new, this wind-boat has many original features

Stenches to Warn Miners of Danger

MOST signaling devices appeal to the eye or to the ear, and the principal means of sending a warning from the surface down to the miners in a metal-mine has heretofore been by messengers, electric gongs or lamps, telephones, interrupting the flow of compressed air, or introducing water in the compressed-air lines.

Recent investigations of the Bureau of Mines in cooperation with several large metal-mining companies have demonstrated that warnings which are perceived by the miners through the sense of smell are easy to install and are on the whole as effective as any other system that has heretofore been used.

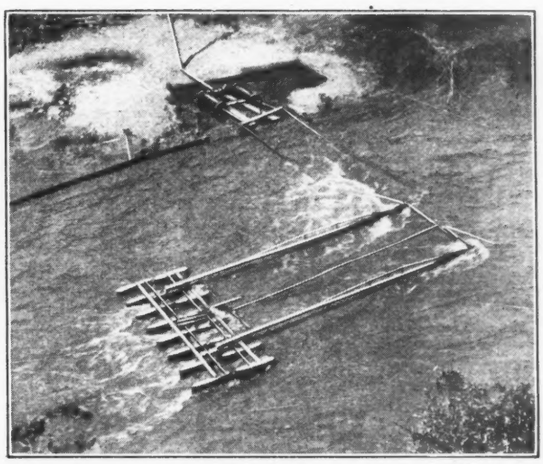
Briefly, the odor system of warning consists of injecting from one half to one pint of a very strong-smelling liquid (preferably one with a vile odor) into the main compressed-air line at the surface. The air current quickly vaporizes the stench liquid and carries it to all parts of the mine where compressed air is used. Thus miners in working places operating air drills receive a positive warning to come to the surface within a few minutes after the stench has been introduced at the mine- or pit-mouth.

These miners have just detected in the air an odor that means, "Come to the surface at once." The odor is produced by introducing a vile-smelling liquid into the compressed-air line

Harness the Streams and Make Them Do the Work

DOES a stream flow through the corner of your farm? If so, get busy at once and put it in harness, for it represents horsepower going to waste. Its energy, created by the same force of gravity that moves the current, will provide electric lights, or it will furnish the electricity for storage batteries; or it will pump water into irrigation ditches.

The cheapest machine yet devised for raising water from a river to any desired level is an invention of F. L. Gilman, of Los Angeles. It is practically a power plant operated by the current of the stream from which the water is taken. The model recently demonstrated before the local Chamber of Commerce forces eighty gallons a minute through a three-inch pipe to a height of eighteen feet, working without a hitch. Engineers declare that this supply is sufficient to irrigate one hundred and sixty acres.

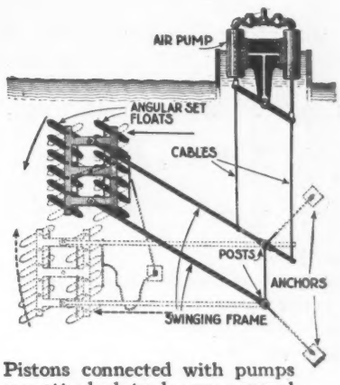


Here is a power plant that is operated by the current of the stream; it will furnish electricity or pump water in irrigation ditches

It is a simple contrivance to be anchored in midstream. Like the old-fashioned ferry, it depends on the current for locomotion. The rudder reverses itself automatically as it reaches the side of the river, giving a swaying motion continuously and of indefinite duration. Pistons connected with ten-inch pumps are attached to the swaying beams, which allow for a twenty-two-inch stroke. Six horsepower is thus obtained; this may be greatly increased by increasing the size of the machine or by placing others in the current.

The initial cost is less than that of an ordinary pumping plant, and once installed no further attention is needed; no expensive engineer is required to control it, not even a caretaker to see that it does its work.

However, a channel with some protecting wall must be made to obviate the catching of drift. This could be easily done, and there is absolutely no expense connected with the operating of the simple motor. Until the river runs dry or its paddles wear out, the harrow-shaped machine will continue to pump day and night for the thrifty rancher and his thirsty acres, thereby saving much labor.



Pistons connected with pumps are attached to beams swayed by the current, and six horsepower is obtained

Filtering Noises Out of Radio

It is done by the use of static eliminators

ONE of the greatest troubles in radio communication is caused by static interference. Static electricity in the air flows into the aerial and passes through the receiving apparatus, producing ugly noises that make long-distance communication almost impossible.

Static eliminators, which are reported to be doing marvelous work, have been developed at some of the transatlantic stations, but they require vast areas and expenditures for their erection. For this reason—ordinary land or ship stations can not use them.

The device here illustrated offers a means of eliminating static and other interferences at the same time. It is an acoustic tone-filter. It will be seen that there is a telephone receiver attached to the larger of two brass tubes constructed so that one fits concentrically within the other. The signals pass through this receiver and into the tone-chamber formed by the two cylinders. The filtered sounds are carried to the ears of the operator by means of binaurals attached to the end wall of the smaller cylinder.

The filtering action is simple. It is well known that any pure sound has a definite period of vibration and therefore a definite wave length. By sliding the smaller cylinder in or out of the larger one until the space encompassed by the two is in resonance with the sound coming from the telephone receiver, any acoustic wave length may be found. Obviously the chamber will not be in tune with more than one signal at a time, any more than two similar organ pipes would produce different notes. This does not hold true when the signals from two or more stations are of the same resultant tone, though such a condition is almost unknown.

The use of this resonant sound chamber eliminates the disturbing noises produced by static interference in the reception of wireless telegraph and telephone messages

The sound produced by static is of a comparatively low value, whereas the modern radio transmitter produces a musical note at the receiving station. This difference in tonal quality is taken advantage of in eliminating the static.

With loud signals, it has been observed that the resonant action of the acoustic chamber upon the diaphragm of the receiver results in an amplified signal intensity. With weak signals a decrease of intensity up to 30 per cent has been observed.

How the German Cables Were Diverted

A war measure establishes a scientific fact

By P. J. Risdon

English correspondent of the Popular Science Monthly
Drawings made by G. H. Davis

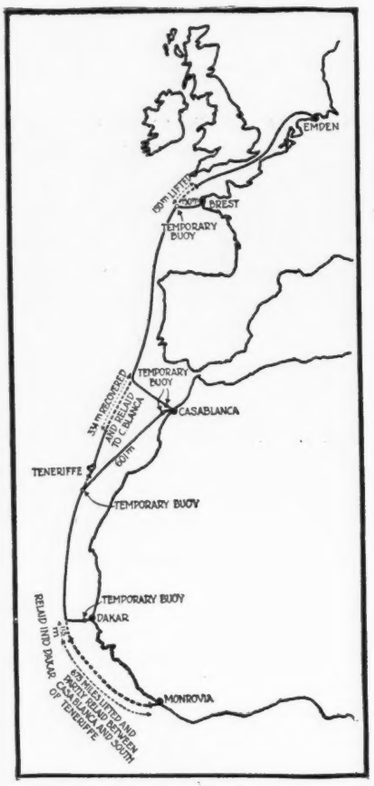
SHORTLY after the declaration of war, all German telegraph cables were cut.

Mr. C. H. Gray conceived the idea of utilizing these cables, and, on behalf of the French government, undertook the operation of converting them. The success of the operations was of immense importance, proving that the recovery in good condition and relaying of deep-sea cables is practicable.

One of the German cables was 3905 miles long, in two sections, one from Emden to Teneriffe and from Teneriffe to Monrovia, West Africa.

The Task Was Begun in 1915

The cable steamship *Dacia* left London in August, 1915. The cable was picked up at a depth of two and one quarter miles by means of a special grapnel, and hauled to the surface. On September 11 it was cut in shallow water off Brest, the southern end was buoyed, and 150 miles were recovered to the northward. One end of this recovered portion was landed at Brest, and nearly all was relaid, and the other end spliced to the buoyed end off Brest. The German cable was under cables belonging to the Allies, which necessitated cutting and grappling it again. A heavy cable was then laid out from Casablanca and buoyed.

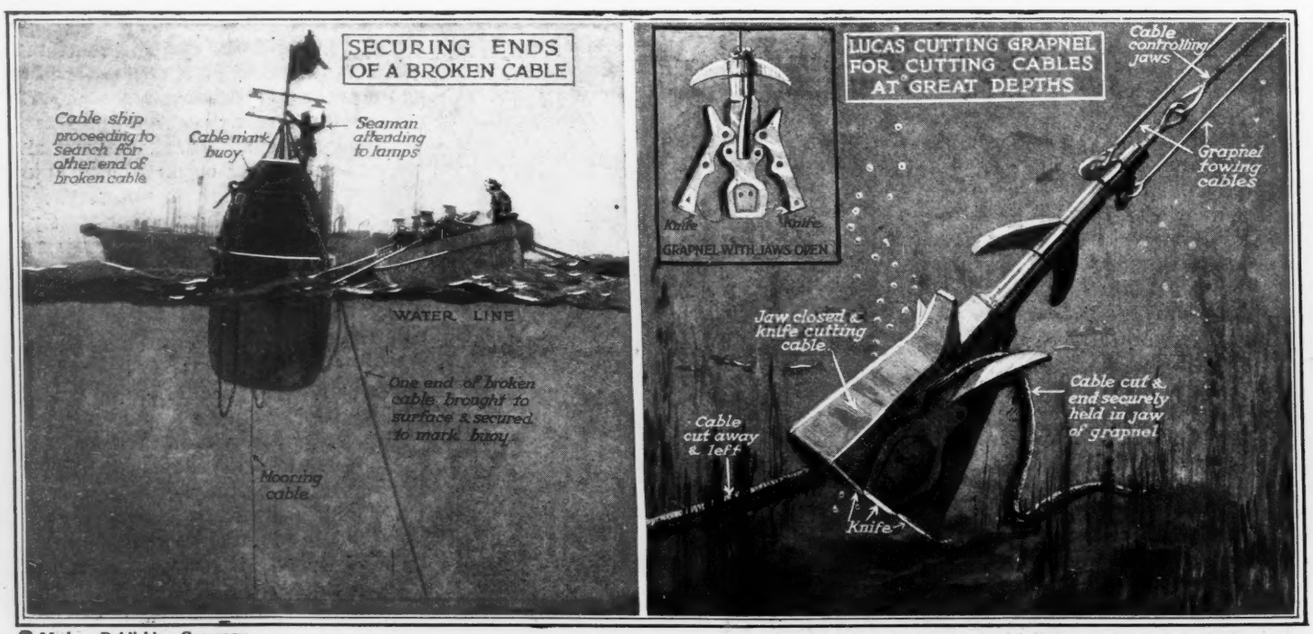


From Brest to Monrovia the *Dacia* steamed, recovering severed German cables. Hardly was the task accomplished than the ship was torpedoed and sunk by a German submarine

From Teneriffe the German cable was again grappled in deep water and lifted, and a length of 334 miles was recovered, of which 328 miles was relaid and spliced to the buoyed end off Casablanca. This completed the conversion of the first section, and thus within four months of beginning work 1400 miles of cable between Brest and Casablanca were at the French government's disposal, less than 500 miles of the cable having been picked up and relaid.

How the Cable Was Located

The second section from Teneriffe to Monrovia was a task of greater magnitude, because a greater length had to be picked up and relaid in a depth averaging two and one half miles, much farther from its original position. A second length was laid out from Casablanca. South of Teneriffe the cable was cut and recovered shoreward. This was landed and laid out from Dakar, and buoyed. South of Dakar the German cable was cut again in deep water, and 115 miles to northward was recovered and relaid to the buoyed end off Dakar. The cable was then cut off Monrovia, and picking up was continued in deep water until 673 miles of good cable had been recovered, of which 601 miles was spliced into the cable off


SECURING ENDS OF A BROKEN CABLE
Cable ship proceeding to search for other end of broken cable
Cable mark buoy
Seaman attending to lamps
WATER LINE
One end of broken cable brought to surface & secured to mark buoy
Mooring cable
LUCAS CUTTING GRAPNEL FOR CUTTING CABLES AT GREAT DEPTHS
Cable controlling jaws
Grapnel towing cables
Knife
Knife
GRAPNEL WITH JAWS OPEN
Jaw closed & knife cutting cable
Cable cut & end securely held in jaw of grapnel
Cable cut away & left
Knife

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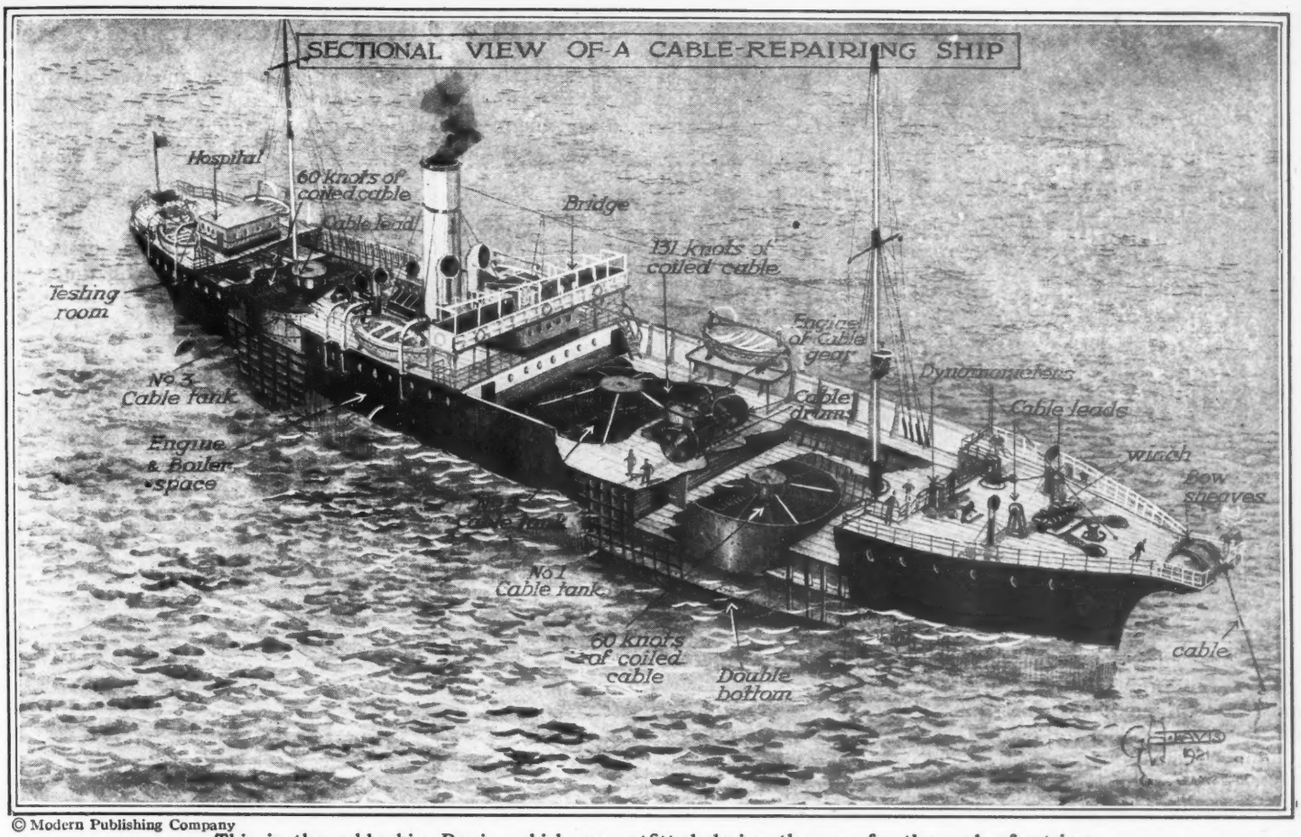
The cable-ship *Dacia* picked up the German cable at a depth of two and a quarter miles, and hauled it to the surface: the feat necessitated the overcoming of many serious difficulties

A special grapnel was devised for the purpose of raising the cable; the operation was a very delicate one owing to the fact that the German cable was laid under those of the Allies



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This is the cable-ship *Dacia*, which was outfitted during the war for the work of retrieving German deep-sea cables and of rearranging them for use by the French government

Teneriffe and relaid to the buoyed end off Casablanca, a distance of from 1400 to 2000 miles away from its previous position.

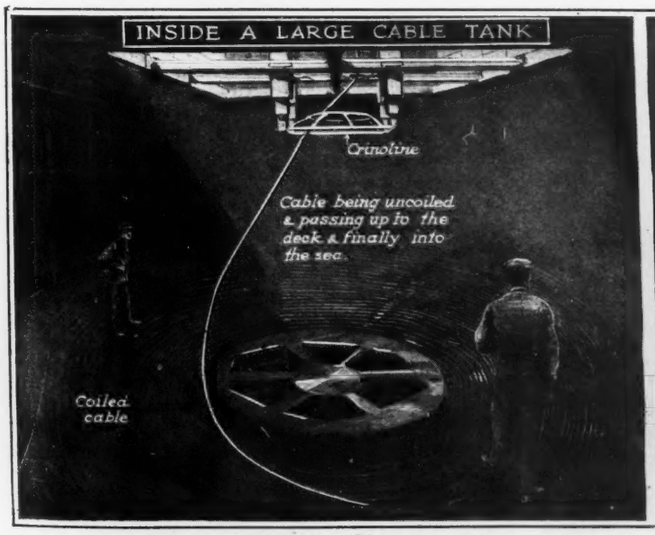
The cable was found by grappling for it at right angles to its length, using about one third more rope than the depth of the water. A good portion lay at a depth of two and one half miles, and to have attempted to lift it on the bight would almost certainly have resulted in straining it to breaking-point. To overcome this difficulty, a special form of grapnel was used, by means of which, when the cable had been found, it was cut on one side and the other end was secured and raised to the surface.

Owing to the fact that the original cable in this vicinity had been cut at the outbreak of war, it had to be grappled for again in deep water when the ship had picked it up to the point of severance.

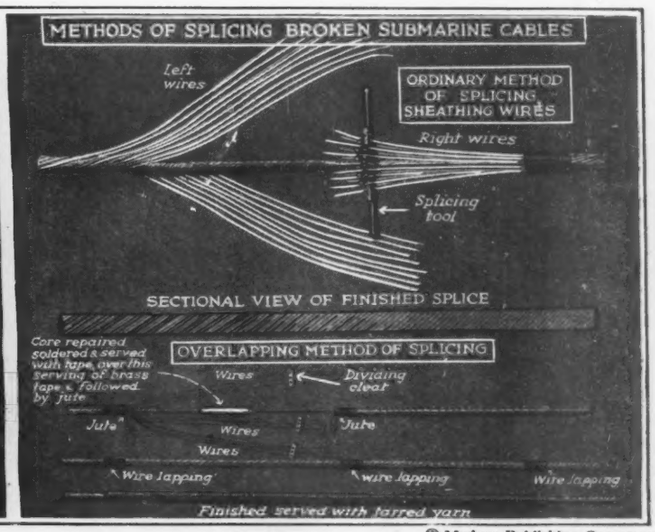
The magnitude of the task under war conditions can scarcely be overrated. Imagine fishing in the night for a cable lying two and one half miles deep in the sea, cutting it at that depth, hauling the end up, and splicing and relaying in new positions, knowing that submarines were always near and the ship liable to attack.

In little more than two years the *Dacia's* work was completed, and almost immediately afterward her armed escort was torpedoed and the *Dacia* sunk by a submarine.

Mr. Gray's persistence and success were appreciated by the French government, who conferred upon him the Cross of Chevalier of the Legion of Honor.



Showing the interior of a cable tank of the ship *Dacia*, where the cable was wound on a huge spool until it was relaid



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Four months after the work of reclaiming the German cable was started, the ends were respliced by the method shown here and then it was used by the Allies

With this instrument the pupil can observe his own vocal cords, while the teacher is able to check his observations

You Can Watch Yourself Talk

AN accurate knowledge of the larynx, the main organ of the human voice, is of the highest importance not only to the medical practitioner, but to the singing-master, the teacher of deaf-mutes, and the student of language who is trained in modern phonetic methods. Anatomy teaches the constitution of the organ, the arrangement and interconnection of its various parts. How it works in producing the infinite variety of human speech is studied by phonetics.

Garcia's laryngoscope was the first instrument that made it possible to study the human voice in a scientific way by means of a beam of light projected from an outside mirror. A decided advance was made by Harold Hays' pharyngoscope, an apparatus comprising a narrow tube with a minute inside lamp, with which nearly all vocal processes can be studied.

The autophonoscope, designed by Professor Panconcelli-Calzia, director of the Hamburg Phonetic Laboratory, is a new scientific instrument for the study of the human voice. It comprises a tube the end of which is introduced into the mouth. The opposite end is intended for the experimenter, while the person experimented on (or the pupil receiving a lesson in phonetics) sees his own vocal organ in the branch-tube. The center tube contains a half-transparent mirror. The instrument also comprises a lamp and sometimes a lens system.

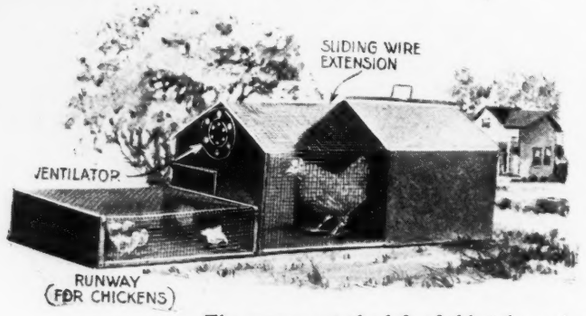
The following are some of the phonetic processes demonstrated by means of this apparatus: normal breathing, noiseless and noisy inspiration, violent expiration, coughing, clearing one's throat, swallowing, and the action of the vocal cords with all varieties of articulation.

Protect Young Chicks from Rats

THE telescoping metal chicken-coop and wire feeding-pen shown below were devised to keep out rats and other enemies. While the coop and feeder are separate units, they may be connected to provide a runway six feet long.

The coop is made of galvanized iron and looks like a small traveling-bag. A wire section is made to telescope inside the coop proper. When this wire section is extended, it forms a runway for the brood hen and the chicks. Its outer end has a small door at the bottom and a ventilator at the top, so that when pushed in entirely the coop has sufficient air.

The feeding-pan is for the small chicks and consists of a bottomless wire box with metal ends and doors.



The runway at the left of this telescoping chicken-coop admits chicks, but is not large enough for the hen

The Sun Does the Family Cooking

EVERY boy knows that with the aid of a magnifying-glass a paper can be ignited and wood burned by focusing the rays of the sun upon it. That being so, why can't the sun's heat take the place of coal?

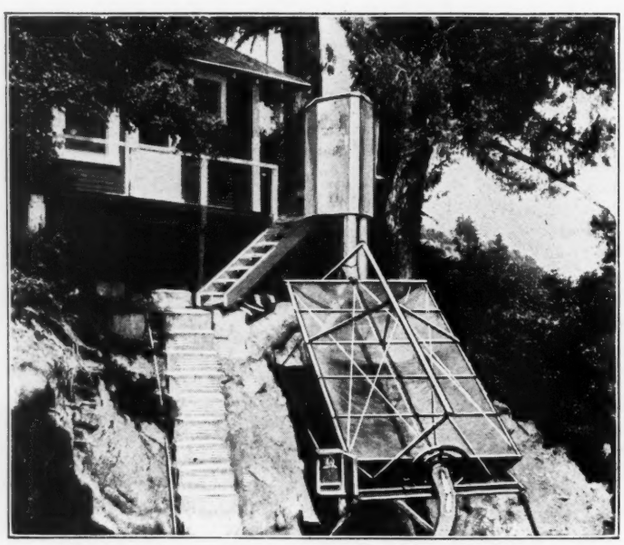
Dozens of inventors have asked themselves that question, among them the famous Captain Ericsson, inventor of the *Monitor*. He spent about $150,000, and then discoveerd that, although the sun's heat costs nothing, a sun-heated boiler is so expensive that it is cheaper in the end to use old-fashioned heating apparatus. Dr. C. G. Abbot, of the Smithsonian Institution, has attacked this problem, but in a purely experimental way. He knows that the day when the sun will take the place of coal is still far off.

In his apparatus we find the usual parabolic mirror that focuses the sun's rays on a boiler—in this case a blackened tube filled with oil. Dr. Abbot uses oil because it boils at over 400° F. Water boils at 212°. Hence the oil absorbs more heat.

The oil flows into the tube from an overhead reservoir and then back into the reservoir in a continuous stream. The oil transfers its heat to two cooking-ovens. A few hours of sunshine are sufficient to heat the oil to such a temperature that cooking can be done all day. It does not matter if the morning is sunny and the afternoon cloudy. The ovens will still he hot enough for any purpose except frying.

Since the sun moves slowly across the sky, the mirror must follow it, so that the rays will always be concentrated on the tube. This is accomplished by means of clockwork.

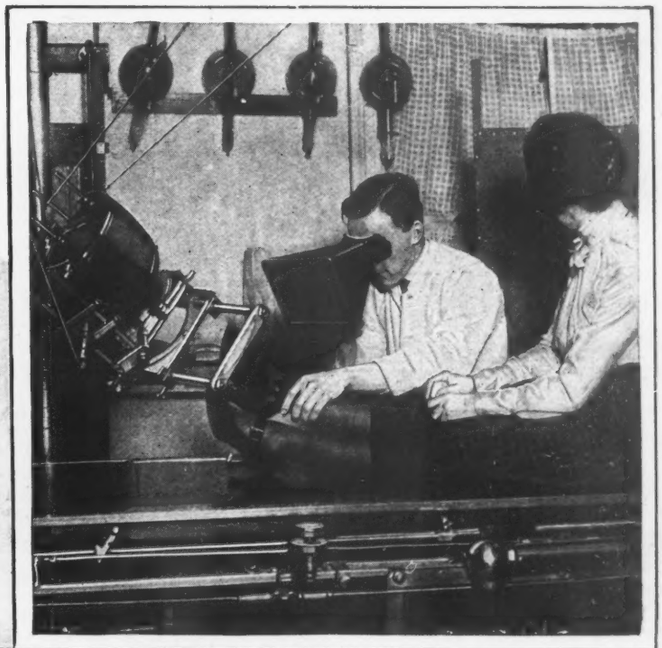
Dr. Abbot did all his cooking last summer with this solar kitchen stove.



By means of a parabolic mirror, oil, tubes, and a reservoir, Dr. C. G. Abbot has been able to utilize the sun's rays for heating two ovens built in the side of the reservoir

How X-Rays Make Life Safe for the Bomb Squad

Why was this a "suspicious" package? We don't know. Perhaps the recipient had an enemy, or had been getting threatening letters. Anyway, he decided to find out what was inside without taking any risk



For some reason, the customs inspector suspected this young woman's shoes of smuggling. He decided to take their picture—the only other way to settle the question would have been to destroy the shoes

Lucky for the man who got that innocent-looking parcel in the mail that he had it X-rayed. It contained a deadly bomb that would have exploded on opening

And this is what the customs inspector's X-ray picture showed: nails in the wooden heels, a metal buckle, and—two rings set with jewels worth thousands of dollars

Raising Wrecked Ships on Cushions of Air

NEARLY two years ago the government dredge *Florida* was caught in a storm off Anastasia island near St. Augustine, Florida, and wrecked, the master and several of the crew losing their lives. Shortly afterward the U. S. S. *Isis*, in the service of the Geodetic Survey, was sent to the scene to chart the wreck as a protection to coastwise navigators. She too was caught in a storm, which swept her on to the submerged tower of the dredge. Her hull was punctured. The crew attempted to run her ashore, but before they could do this she foundered.

Since then three attempts have been made to salvage the *Isis*, and each has met with disaster. The *Isis* lies in about thirty-five feet of water, so close inshore that she is in the line of the breakers. This and a sweeping, oily land-swell keeps the surface in constant agitation. Below a strong undertow surges, making it difficult for divers to work. Storms are frequent, and near by on Crescent beach lie the bones of a fine four-masted schooner—all that remains of the work-boat employed in the last salvaging effort.

A salvaging expedition arrived in St. Augustine recently on the steamship *Blue Point*, employing new principles. These include a "mechanical mole," which, guided by an electrical control-board on the work-boat above, burrows under the wreck, performing many functions hitherto possible only to the human diver; and the resilient collapsible pontoon, which resembles a great football when inflated and exercises a lifting power of twenty-five tons in water. These pontoons are sunk about the hull and attached to the keel, pumped up, and bring the wreck to the surface on a cushion of air.

One of the huge inflated balls—resilient, collapsible pontoons. Although it is filled with air, it weighs one thousand pounds, and is capable of lifting twenty-five thousand pounds in the water

Here is the interior of the plain-looking suitcase on the right: manipulating the puppets on wires, Miss Boothe teaches children lessons in hygiene

After the little figures have told their health stories, they are carefully placed in packets and laid away in the suitcase till the next lesson

She Carries a Complete Theater in an Ordinary-Sized Suitcase

A MINIATURE theater, which is carried from place to place in a suitcase, together with its properties and hand-painted paper stage folk, is being used by Miss Stella Boothe, a specialist in child hygiene, to convey to children the idea that good habits lead to health and happiness. Miss Boothe, whose ability as a lecturer on hygiene for children has been recognized by the United States Public Health Service, perfected her teaching scheme after consultation with some of the leading psychologists and physicians. Her aim is to put "punch" into the health lesson by building around each idea, such as the need for fresh air and the need for sleep, an interesting fairy story acted by the paper dolls while she recites the dialogue.

Mary Gay has the principal rôle in each of the stories. She goes through many adventures, eventually learning that such things as good food, morning baths, early rising, plenty of sleep, and much fresh air will make her big and strong. Her early-to-bed lesson, which is typical of the set of stories, lets Miss Boothe's juvenile audiences see her being warned against listening to the *Dragon of Ignorance* by a night-gowned child who knows that little girls should not stay up late. *Late Hours*, clad in a cape trimmed with "the sparkles from children's eyes," is chased out of *Mary Gay's* room. Throughout the dialogue Miss Boothe manipulates the characters by means of fine wires.

Thus far Miss Boothe's lecture tours in rural districts, and also in the big cities, such as New York, Philadelphia, Spokane, and Cleveland, have met with remarkable success. The fame of the Mary Gay plays and the miniature theater has reached even far-away China.

Miss Boothe's first theater was not of suitcase size by a good many pounds. But one day the idea of using a suitcase came to her, and immediately she set about the construction of a miniature theater. The suitcase she uses in her lectures now is twenty-nine inches in length, eighteen and one half inches wide, and four inches deep. It weighs, when filled with the shellacked paper properties and the characters, each in its envelope, only ten and one half pounds. When on a lecture tour, Miss Boothe needs only to address it to herself at her next stopping-place and consign it to the care of the post-office.

The interest of children as old as twelve years can be held easily by the lectures. And once a university faculty sat for an hour while the dolls danced and Miss Boothe lectured.

The Problem of Fooling the Cream Thief

PERFECTLY honest forty per cent cream leaves an up-state creamery in a can addressed to a New York hotel. When it arrives, the butter-fat content may have shrunk to twenty per cent or less. Somewhere along the line the can has been opened, the cream stolen for sale, and the shortage made up with milk. Many persons handle a can of cream in transit—creamery drivers, railroad employees at stations and in cars, teamsters delivering to hotels and restaurants. Detection of theft is therefore difficult. Cream-stealing has been one of the hotel man's grievances—not only the loss of cream but possible contamination of a delicate food article in transit.

A new way of shipping cream has lately been devised to prevent theft and contamination. Shipments are made in a new type of cream-can with double walls and a vacuum, on the vacuum-bottle principle. It is a very sturdy receptacle compared with the common milk-can—made of sheet steel and almost like a shell in its thickness of metal. Cream cooled and sealed in this can will retain its temperature with a change of hardly more than two degrees on the hottest day. Moreover, the can may be left outdoors in the severest weather, freezing being almost impossible in ordinary shipping conditions.

The top of each can, when sealed down, is fastened with a padlock. This lock can be opened by only one key, which is in the possession of the hotel or restaurant man to whom that particular can of cream is shipped. Thus it is thief-proof, dirt-proof, and climate-proof.

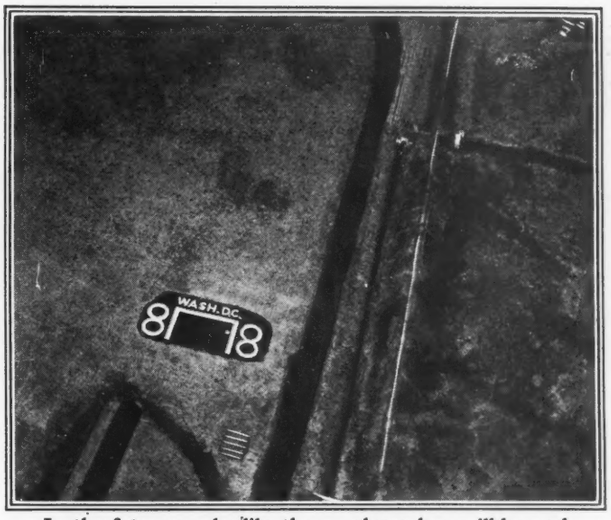
To prevent cream-stealing and contamination of the contents of milk-cans in transit, a receptacle has been put on the market that is locked and can be opened only by the recipient who holds the key

Cities Marked in Light to Guide Airmen

IF the plans of the recent International Air Convention are ratified by the government, the near future will see every city of any size in the United States blazing at night with a number that will enable airmen to tell exactly where they are. The scheme provides for a unit sheet covering one degree of latitude and one degree of longitude, designated by a locality name and by unit digits.

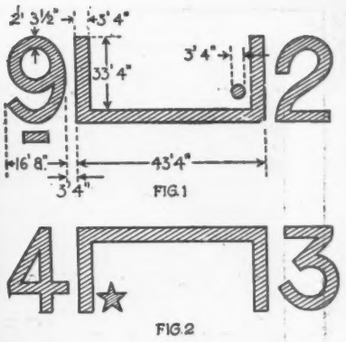
In addition to the customary latitude and longitude notations, the local aeronautical maps are to bear numbers, enclosed in rectangles, corresponding to a new system of coordinate reckoning. This new "grid" reckoning, with regard to latitude, begins at the South Pole as zero and increases northward by degrees and minutes to 180 degrees at the North Pole; with regard to longitude it begins with the antemeridian of Greenwich as zero, and runs easterly by degrees and minutes to 360 degrees or back to the Greenwich line.

In these designating coordinates, the figures referring to the South Polar distance are written first. A sheet whose southern boundary is 49° N. (*i. e.*, 139° South Polar distance) and western boundary 2° E. (*i. e.*, 182° from Greenwich) is numbered 139-182. A dot in the marker will indicate the approximate position of the town with respect to the north or south half of the unit sheet.



In the future marks like the one shown here will be used to point out landing-places for aviators. Such a mark will tell an aviator what latitude and longitude he is in

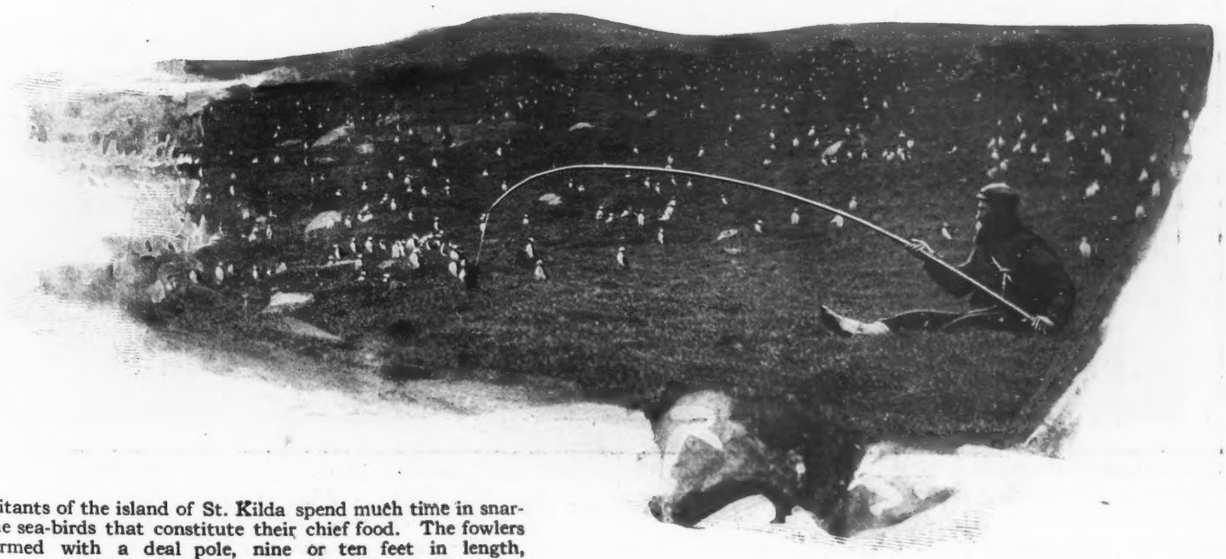
The figure "9" on the west side of the marker indicates that the town is in the section bounded on the south by 139° latitude (new reckoning); the figure on the east side of the marker indicates the position of the town in the section bounded on the west by 182° longitude (new reckoning). The dot in Figure 1 indicates the town as in the southeast corner of the unit sheet, while that in Figure 2 puts the town as just above the center and near the westerly edge of the sheet covering the unit 54° South Polar distance (36° S.) and 173° longitude, new reckoning (7° W.). The center illustration shows the marker recently laid near Washington, D. C. Washington is in the upper right-hand corner of the unit sheet bounded on the south and west by 38° latitude and 78° longitude (128° and 282° new reckoning), so that the open side of the marker is to the south and the relative position of Washington on the unit sheet is shown by the dot.



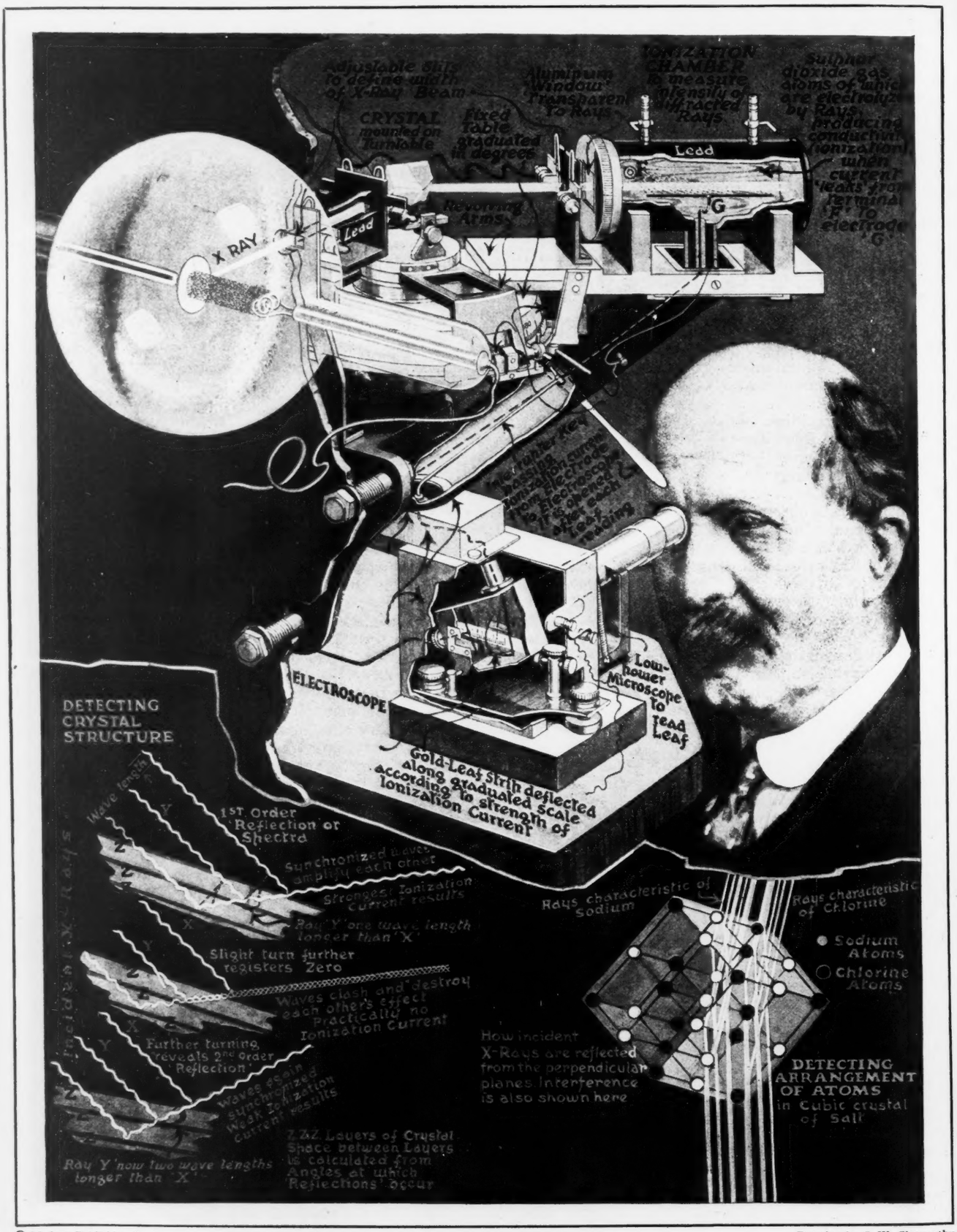
This gives the actual dimensions of the figures and special marks. The star represents the north and the dot represents the south

The Air Service urges that the marker be placed on the right-hand side of every railroad track where it enters the town, so that a pilot lost or bewildered, flies until he picks up a railroad track, which he follows until he sights one of the identification marks on the right-hand side of the track on the outskirts of the city. If only one marker is possible, preference should be given to the north of the town.

Fishing for Birds on the Island of St. Kilda



Inhabitants of the island of St. Kilda spend much time in snaring the sea-birds that constitute their chief food. The fowlers are armed with a deal pole, nine or ten feet in length, with a noose made of horsehair and quills. The fowler pushes his rod along the ground close to a puffin's head. By a dexterous turn of the wrist he drops the noose over the bird's neck


Adjustable Slits to define width of X-Ray Beam
Aluminum Window Transparent To Rays
IONIZATION CHAMBER to measure intensity of diffracted Rays
Sulphur dioxide gas, atoms of which are electrolyzed by Rays, producing conduction (ionization) when current leaks from terminal 'F' to electrode 'G'
CRYSTAL mounted on Turntable
Fixed Table graduated in degrees
Lead
Revolving Arms
G
X RAY
Lead
ELECTROSCOPE
Low-power Microscope to read Leaf
Gold-Leaf Strip deflected along graduated scale according to strength of Ionization Current
DETECTING CRYSTAL STRUCTURE
Wave length
1st Order Reflection or Spectra
Synchronized waves amplify each other
Strongest Ionization Current results
Ray 'Y' one wave length longer than 'X'
Slight turn further registers Zero
Waves clash and destroy each others effect Practically no Ionization Current
Further turning reveals 2nd Order Reflection
Waves again synchronized Weak Ionization Current results
Ray 'Y' now two wave lengths longer than 'X'
Z Z Z Layers of Crystal
Space between Layers is calculated from Angles at which 'Reflections' occur
Rays characteristic of Sodium
Rays characteristic of Chlorine
Sodium Atoms
Chlorine Atoms
How incident X-Rays are reflected from the perpendicular planes. Interference is also shown here
DETECTING ARRANGEMENT OF ATOMS in Cubic crystal of Salt

© Modern Publishing Company

Drawing by S. W. Clatworthy

The Braggs' Apparatus for Studying Crystals

A tiny beam of X-rays is passed through a crystal of salt and then strikes an "ionization chamber" connected with a strip of goldleaf in an electroscope, which moves over a graduated scale and measures the amount of electrical energy that is left in the X-ray after passing through the crystal at different angles. The reflection caused by the different layers of atoms absorbs different amounts of energy from the X-ray, and by turning the crystal the electroscope shows how these atoms are arranged.

The lower part of the drawing shows the arrangement of atoms in salt as discovered by the apparatus designed by Sir William Bragg and his son. The square shape is the crystal; the dots show the positions of the atoms composing it

How an Ounce of Iron Might Blow Up a City

If man could release the powerful force that holds atoms together the world's power problems would be solved

Do you believe that engines may some day be run with the power hidden in paving-stones?

Did you know that the modern theory of matter—the electron theory—tends to prove that everything in the world, your body included, is made up of electricity? The world appears to be a mass of pure electricity.

The full significance of these experiments has never been pointed out in an American magazine. The article on this page will open your eyes to revolutionary discoveries in modern science.—The Editor.

SCIENTISTS today are probing the secrets of an explosive power capable of blowing the universe to pieces. When Sir Oliver Lodge startled the world with his declaration that an ounce of ordinary matter contained sufficient energy to lift a whole fleet of battleships from the water, he was not talking pure theory. In the past ten years the truth of this theory has been demonstrated. All modern scientists now accept it as a working hypothesis to explain the constitution of matter and chemical action.

Almost unrecognized by the general public, two English scientists, Sir William L. Bragg and his son, W. Lawrence Bragg, have actually been studying the structure of crystals with invisible X-rays. They have found how the tiny atom is systematically arranged to build up crystalline matter.

Every one is familiar with the old definition of the atom. An atom of iron is the smallest unit of iron that can exist and maintain its identity. According to this old view, it is so small that you cannot divide it into two pieces. It has been calculated that if a drop of water were magnified to the size of the earth, the atoms of which it is composed would be about the size of baseballs. Yet after X-rays were discovered, physicists began to wonder whether, after all, the atom was the smallest conceivable unit of matter.

For in an X-ray tube there is a glow of bluish light called "cathode rays" that produce X-rays after they strike a "target." One day Sir William Crookes held a magnet outside the tube—and the cathode rays were attracted just as if they had been iron filings.

"This can't be ordinary light," argued Crookes. "You cannot deflect sunlight or artificial light by a magnet."

Radium Sets Scientists Guessing

Then radium was discovered, and it was found that something was being given off by radium—in fact, that part of radium emanation changed into helium. Since radium was an element, this transmutation could not be accounted for under the old atomic theory.

So a new theory of matter was evolved—namely, that every atom was not indivisible but composite, built up of electrons, moving about a central nucleus, just as the solar system is composed of the sun and its planets. The cathode rays are composed of electrons. Electrons are incredibly small. Tiny as is the atom of hydrogen, its mass is eighteen hundred times greater than that of an electron.

Since everything is made up of electrons and their nuclei of positive electricity, there is actually only one kind of matter. Iron, oxygen, mercury, and sulphur differ from one another utterly, but they differ only because the electrons of which they are composed are grouped in different ways inside the atom.

Such was the theory and it was greatly strengthened later by experimental evidence brought about by X-ray study of crystals. The old dream of the alchemists, the dream of turning lead into gold, now comes within the realm of scientific possibilities. In fact, one element has actually been changed into another by Rutherford.

A few years before the war it occurred to the German mathematician, Laue, of Munich, that perhaps X-rays would reveal the structure of atoms. There must be some systematic arrangement, since nearly all solid matter is composed of crystals having a regular geometric shape. The number of faces and the angles between them, for example, is always the same for each substance. Surely this invariable shape must be produced by an orderly arrangement of the atoms within it.

These calculations were verified experimentally by other experimenters and particularly by Henry Moseley, a brilliant young English scientist. By turning X-rays on matter he proved that its structure might be ascertained. X-rays will pass through flesh; they make your bones cast a shadow. Moseley showed that the arrangement of atoms that form the skeleton of crystals might be similarly revealed. He extended this investigation and found that he was actually able to count the number of electrons in each atom!

The exact positions of the atoms in a crystal were determined by the Braggs and by Dr. Hull of Schenectady by further experimentation. The Braggs invented and used the improved apparatus illustrated on the opposite page. For the first time in history, scientists were able to state definitely that all things in the universe were built up of two things, and only two things: positive and negative electricity—positive nuclei and negative electrons.

A Danish physicist, Bohr, proceeded on the hypothesis that the simplest atom, which is that of hydrogen, is composed of a central nucleus of positive electricity around which moved one electron of negative electricity. All the atoms of the different elements have this nucleus of positive electricity and differ from one another only by the number of units of charges that make up the positive center and the number and arrangement of the electrons revolving about it. Thus in uranium the positive "sphere" is the center of 92.

Will the Atom Explode?

Curiously enough, all this dovetails into what is called the table of atomic weights. The lightest atom of all, hydrogen, is put at the head of a new table of atomic numbers. Its number is 1. It has one electron. Farther down is oxygen. Its weight is 16. It has eight electrons. There is always a simple numerical relation (number of electrons in atom × two = atomic weight) between the weight of an element and its electrons. Of heavier atoms, this is only approximately true.

What holds the electrons together? Some immensely powerful attractive force. Those who attempt to utilize it are taking their lives—and ours—into their hands. If the equilibrium of an atom were destroyed by changing the positive nucleus, that atom would explode. So might the next, and the next, and the next. In a flash the whole earth might be torn asunder.

But if this fearful explosive power can some day be used in orderly fashion, transportation, production, and all industry may be given incredible speed, and the world as we know it may be completely made over.

What Makes Water "Taste"?

Microscopic creatures that pollute water supplies

By Leon Augustus Hausman, Ph.D.

DURING the months of spring and early summer there frequently develop, in reservoirs, a host of minute creatures that impart to drinking waters various "fishy" and other disagreeable odors and tastes. It is commonly supposed that such odors and tastes are due to the decomposition of fish or other animal or plant forms in the central reservoirs. As a rule, such is not the case. The unpalatable flavors imparted to drinking waters are usually caused by the presence of two groups of organisms, which develop quite naturally within the waters, known as protozoa and algæ. The former are minute, one-celled animal forms, the latter microscopic plants.

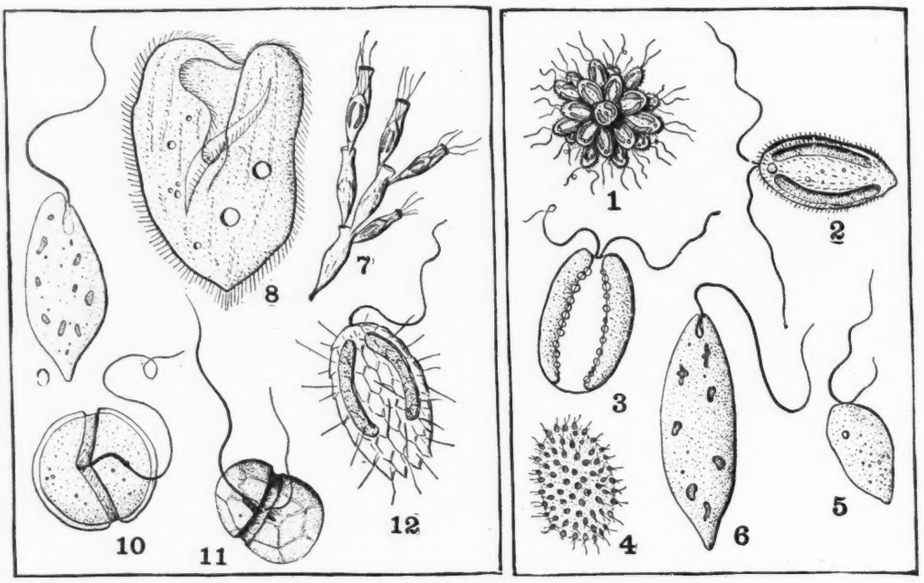
What Protozoa Are Like

The aromatic odors of drinking water, together with the grassy or "hayey" odors, are due to the algæ forms. These are usually not sufficiently unpleasant to cause much discomfort. But the more objectionable odors and strong tastes of fish or of some decaying substance is due to the protozoa.

These minute forms are composed of but a single cell, made up of pure protoplasm, and vary in size from two to eight hundred microns. For purposes of comparison, it is convenient to note that the diameter of the average human hair is fifty microns. Practically all of the water-polluting protozoa lie below the limits of fifty microns along the longest axis of the body.

The noxious odors and tastes are imparted during either the growth or the disintegration of the protozoa. With the growth of some forms certain organic oils are liberated from the body, giving to the water an odor or taste distinctly different from that imparted by the dead and disintegrating body of the same species. Furthermore, the odors and tastes from any one form differ in *quality* as their intensity changes. Thus an odor or flavor that is innocuous or even pleasant in its aromatic or spicy quality when but faintly detectable, often becomes disagreeable when present in larger amounts. In many cases the odors and tastes due to protozoa are distinctly characteristic of the species producing them, and so may be used as a criterion for determining the species present in odorous water samples.

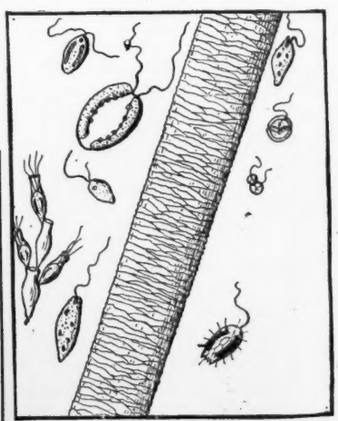
The amount of the oil (termed by the author "protozoan oil") required to produce an appreciable odor in drinking water is in some instances extremely small. Thus the oil produced by *Synura* (Figures 1 and 2) can readily be detected when diluted in water to the extent of one part in



Some of the Little Creatures that Pollute Our Reservoirs

1 and **2**, *Synura uvella:* length, 30 microns; brown or yellowish; imparts to water muddy appearance, odor like cucumbers, and bitter taste. **3**, *Cryptomonas ovata:* 50 microns; imparts grayish-green color; in small numbers imparts violet-like fragrance; in large numbers, putrid odor and taste. **4** and **5**, *Uroglena americana:* 20 microns; imparts fishy odor and taste. **6**, *Euglena hematodes:* 40 microns; has reddish granules that impart "bloody" hue; taste, faintly fishy. **7**, *Dinobryon sertularia:* 30 microns; gives off fishy or seaweedy odor. **8**, *Bursaria truncatella:* 450 to 700 microns; faintly visible to the naked eye; imparts "salt-marsh" taste. **9**, *Euglena sanguinea:* 50 microns; resembles its relative, *hematodes.* **10**, *Glenodinium pulvisculus:* 18 microns; one of the least noxious forms; odor and taste, faintly fishy. **11**, *Peridinium cinctum:* 15 microns; befouls water with nauseating odor and taste as of dead clams. **12**, *Mallomonas* (species not yet determined): 25 microns; in small numbers imparts fragrance like that of violets; in large numbers gives off fishy odor; often tints water yellowish

Part of the author's laboratory, where he carries on the minute and painstaking investigations that have resulted in the discovery of many pests that pollute drinking water



Here are nine of the species of water-polluters printed at the top of the page, assembled to show their relative sizes. They vary from ***Cryptomonas ovata,*** fifty microns in length, to ***Peridinium cinctum,*** fifteen microns in length

twenty-five million! That this oil is possessed of remarkable intensity of odor will be appreciated when it is stated that from tests made by the author it was recently determined that oil of tansy, which is intensely penetrating, does not give off a recognizable odor when diluted with more than one million times its volume of water.

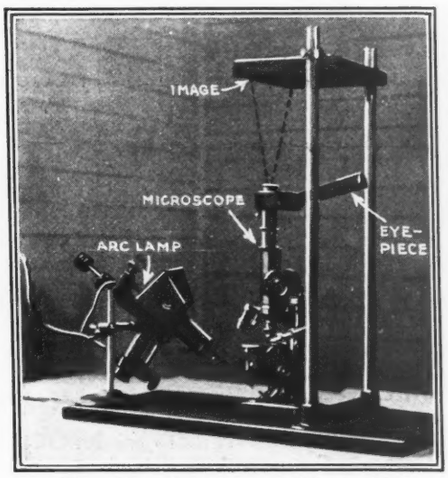
Since the decaying bodies of the protozoa also flavor water, it is not desirable to resort to methods of killing those forms that have already invaded a reservoir, since this may assist in the liberation of a large quantity of oil from the decomposing bodies at one time. Where this has been done, filtration and aeration of the water by special methods must be resorted to.

How Protozoa Are Killed

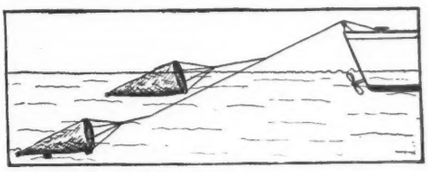
Instead, preventives of the growth of the noxious forms are more to be desired. The simplest of these is copper sulphate. Bags of copper sulphate crystals, dragged behind a boat back and forth over the surface of a reservoir or lake, quickly kill what few forms of noxious protozoa there may be present, before they have a chance to multiply and pollute the water beyond all hope.

Experiments seem to indicate that the introduction into reservoirs of certain of the larger carnivorous forms of protozoa, not in themselves harmful, may serve to keep in check the undesirable species. The introduction of fish is entirely useless, since not even the newly hatched fish of any species feed upon such minute forms as the water-polluting protozoa such as are here shown.

Not only do the water-polluting protozoa impart odors and tastes to water, but they also produce muddy or cloudy hues, rendering it unattractive to the eye as well as to the nostrils and palate. This is true of all of the species when they are present in sufficient numbers, as they frequently are.



The ultra-microscope used in experiments. The beam from an arc light is projected through the microscope to the object under observation



Nets made of silk of the finest mesh, trailing from small boats, gather the specimens; these nets will take any form of more than twenty microns

The most common of our water-polluters are grouped in a drawing reproduced on page 28. The curious creatures are shown as they appear under the compound microscope. In the lower picture on the same page the relative sizes of some of them are graphically indicated. It is interesting to note that the matter of size seems to have nothing to do with the relative unpleasantness of these midgets.

In order to secure specimens for study in the laboratory, where various experiments with controls, killing reagents, etc., are carried on, various devices have been made for taking them from the water. One of these is shown in a picture below, trailing from a boat. These nets are made of silk of the finest mesh and are capable of taking specimens of any size more than twenty microns in diameter.

Details of Necessary Study

In order to combat successfully the inroads of the protozoa, studies must first be made of the creatures themselves, and knowledge obtained of the structure of the forms, the nature of the protozoan oils that they excrete, their life histories, length of life, and the best reagents for their destruction.

The subject makes an interesting study, and the student will be rewarded not alone by the practical value of his discoveries, but by a deeper understanding of nature and her works.

The First Periscope Stowaway

ON the *Princess Matoika*, coming from Antwerp to New York, one of the officers noticed a pipe sticking out of a pile of coal. He ordered an investigation, and the coal was cleared away.

As the coal-pile decreased, the pipe was found to lead to a box. To the amazement of everybody, a stowaway was discovered hiding inside.

Although food had given out, he was able to breathe comfortably through his pipe and even to hear something of what was going on above his head.

Belgian officers of the law who had searched the vessel for an escaped prisoner routed out twenty-five other men and boys who had hidden themselves in various parts of the boat, but failed entirely to notice the retreat of this enterprising stowaway, who said he had embarked at Antwerp.

This enterprising stowaway thoughtfully provided himself with a pipe through which to breathe

Canada's Activity in Aeronautics

SOME months ago Canada bought ten airplanes.

There were several reasons why she needed those planes. In the first place, some were for patrolling the great forests; some were to be used in cooperation with the Northwest Mounted Police. Also a transportation and freight line was projected between Edmonton, Great Slave Lake, and Fort Norman.

Oil had recently been discovered in that region and it was in anticipation of the rush of prospectors that the air route was planned.

Here is just one instance of what the airplanes will mean to certain parts of Canada, or for that matter, to any country where the railroad has not yet penetrated: with dog team or canoe the trip from Moose Factory to Cochrane took from three to six weeks; by airplane it took two hours!

Creating Steam by Electricity

Though the electric boiler has been perfected for industrial use, it is practicable only where the cost of fuel is exceptionally high

By Raymond Francis Yates

Electric boilers are taking the place of fuel-fired boilers in Switzerland, where the cost of coal is prohibitive.

The new electric boiler shows an efficiency of 95.7 per cent. As a steam-producing unit it is far more efficient than the conventional form of boiler. It can produce as much as 1200 pounds of steam in a single hour with a power consumption of only 146 kilowatt hours.

IF we had a heavy electric current at our disposal and caused it to pass through a container of water, the temperature of the water would be raised to the boiling-point. The current would be led in and out of the water with two carbon electrodes.

An electric boiler working on this principle has been perfected in Switzerland. We must understand at the outset that these electric boilers are not used for general power purposes. That would not be economical, since the transformation of electric power to steam power is always carried out with considerable loss. It is profitable to employ the electric boiler only where steam is used for certain industrial operations and where the cost of fuel is exceptionally high.

What Is an Electric Boiler?

A study of the electric boiler illustrated at the bottom of this page will give you a very good idea of its general construction and working features. Two heavy carbon electrodes are suspended in the water, and these are connected with the electric power line. The heavy current, in passing from one electrode to the other through the water, raises the temperature of the water to the boiling-point.

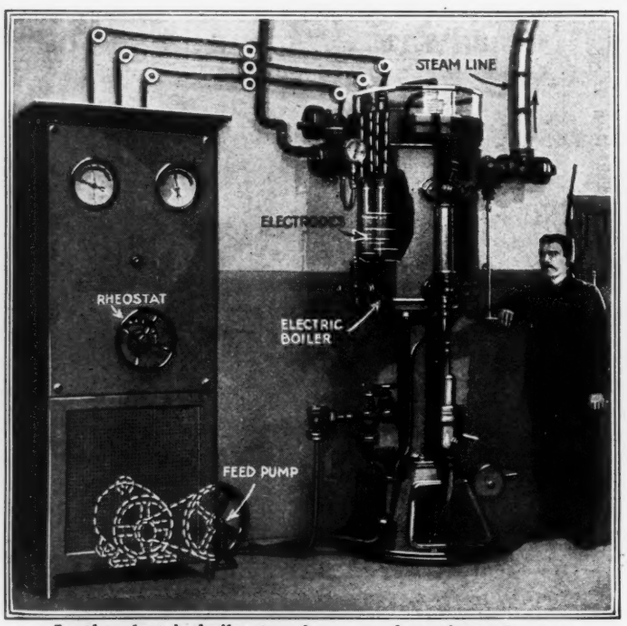
This electric steam generator or boiler is capable of producing 1200 pounds of steam an hour when the voltage of the current is 500 and the current strength 380 amperes. A very good quality of steam is produced that has a water content of only 3 per cent. Ordinary boilers produce steam with a water content as high as 5 and 10 per cent. The efficiency of the generator is 95.7 per cent.

The quantity of steam produced is easily regulated by adjusting the water-level. The lower the water-level becomes, the higher the current density at the electrodes. This naturally increases the current consumption and evaporates more water. A simple apparatus automatically adjusts the water-level for a definite degree of steam production. A small electrically driven pump supplies the boiler with water.

The drawing on the opposite page shows a typical installation where a single electric boiler is used to supply steam to a factory. This factory, which is located in Switzerland, obtains its power from a canal. The water from the canal is allowed to pass through a water turbine, and this turns a long line-shaft to which the machinery in the plant is belted. The line-shaft is provided with a large clutch, which may be used to throw the turbine out of connection.

During the night, when the rest of the plant is not operating, the turbine is used to drive a powerful electric generator that supplies current to the electric boiler. Steam is generated in the boiler, and it flows from this point into the two storage boilers shown at the right side of the picture. These boilers are thermally insulated, and the stored steam is prevented from condensing until it is used the next day. These boilers have an enormous storing capacity. They can withstand a maximum pressure of 18 atmospheres (265 pounds). The steam that accumulates in the storage boilers during the night is sufficient to supply the plant the next day.

A battery of the fuel-burning boilers is included in the equipment of the plant. These are used when the water in the canal is low or when the canal is emptied for cleaning purposes. In an emergency of this nature the stand-by boilers are started. They generated steam for the steam-engine shown on page 31.



In the electric boiler two heavy carbon electrodes are suspended in the water, and these are connected with the electric power line. The current raises the temperature to the boiling-point

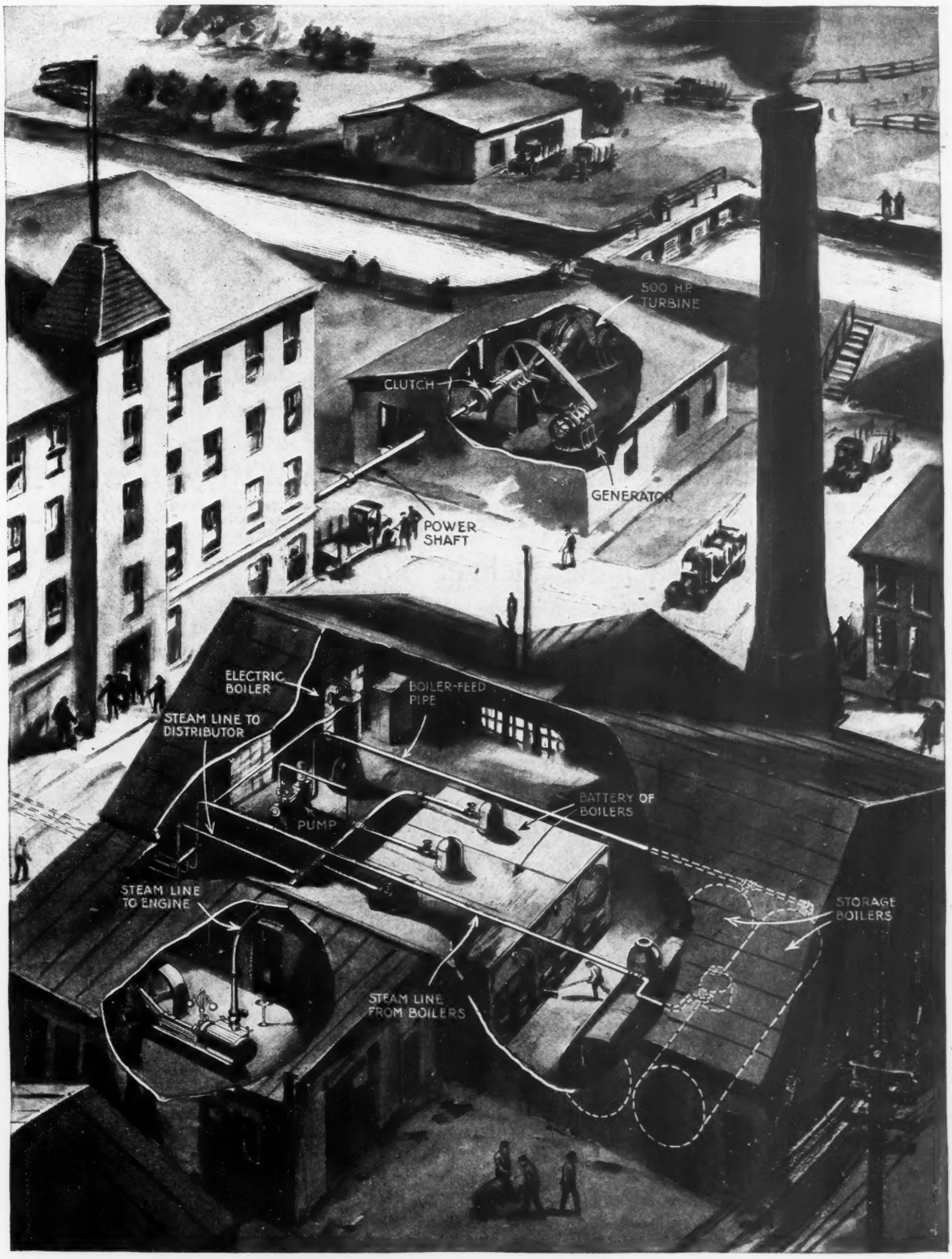
Steam-Storage Boilers Are New

The electric boiler will probably never come into general use for power purposes, but it is finding wide application for special purposes such as the one here outlined.

Here in America, where we have plenty of fuel for all purposes, there is no need that can be filled by its use.

The steam-storage boilers used with the electric steam-boiler are especially interesting. They represent a departure in steam engineering. They have an efficiency of 83 per cent over a twenty-four-hour period.

The total capacity of the storage boilers in thermal units is 4,000,000. A total pressure of 12 atmospheres may be reached with perfect safety as a normal working load. This may be the initial pressure of the boilers when the day's work is started. At the end of the day the steam pressure falls to 2.5 atmospheres.

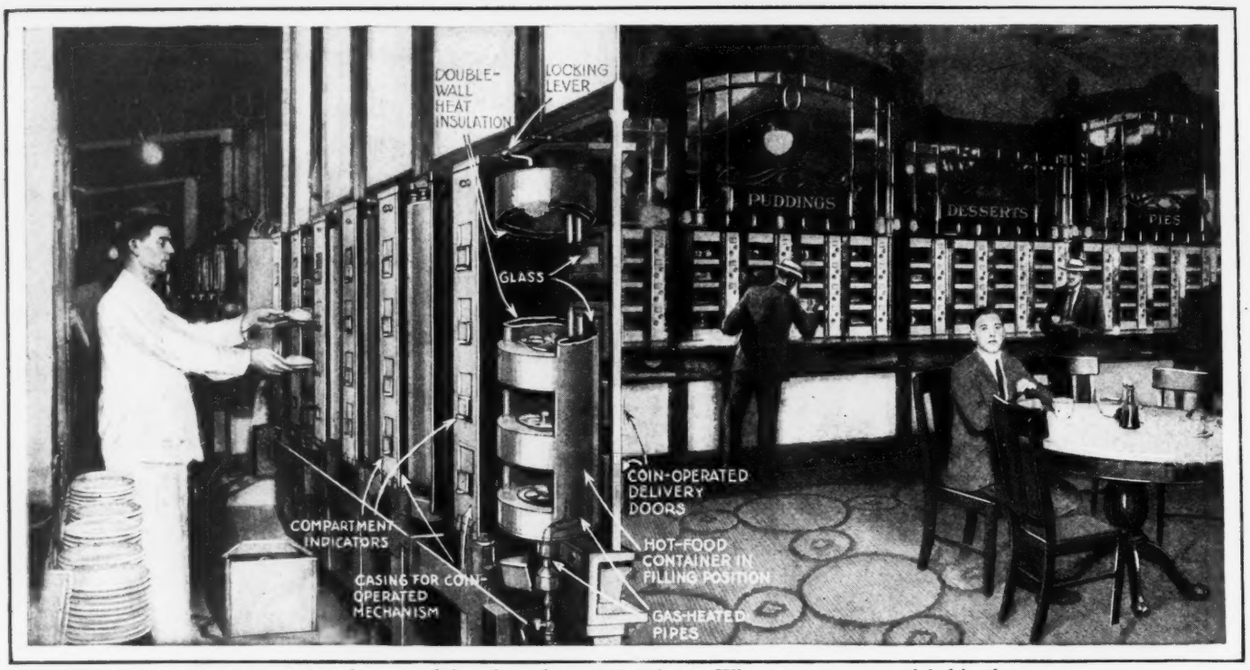


The New Boiler in which Steam Is Generated by Electricity

This shows how the electric boiler is used to supply steam for manufacturing-process purposes.

When the machinery of the plant is idle during the night, the water turbine drives an electric generator that supplies current to the electric boiler. The boiler, in turn, feeds steam to two large storage boilers, which supply the factory needs the next day.

The electric boiler is capable of producing as much as 1200 pounds of steam an hour when working at full capacity



The food is placed on shelves in a revolving drum by an attendant. When you put your nickel in the slot, the glass door in front of the food opens, you lift out the food, and carry it to your table

Slot-Machines Deliver Your Food

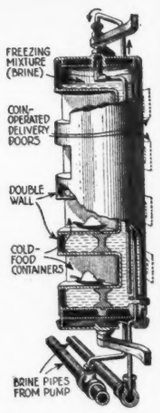
DROP a nickel in the slot, and the glass door opens in front of the piece of pie you covet—such is the system in the wait-on-yourself restaurants that grow more popular every day. There are little glass doors in all four walls of the restaurant, and behind them are plates of food. You find the dish you want, and drop the required number of nickels in the slot alongside of it. The door opens and you take out your dish—no waiting for waiters and no tipping.

But how about the other side of the wall? The picture above shows it in detail. The food is placed on shelves in small revolving drums by an attendant who keeps a close watch on his particular section of wall. The drums are then swung around so that the food faces front.

Suppose you want some ice-cream. Will it be sufficiently hard and cold after remaining in its compartment, for, perhaps, an hour? Yes; the ice-cream and cold-drink drums are kept cool by means of hollow jackets in which cold brine flows. The brine is continually pumped through the jackets.

Similarly, drums that contain hot food are kept hot. Gas-heated pipes run through each drum, and the drum itself has a double wall that keeps the heat in. Hot drinks are kept in tanks. When you insert your nickel in the coffee slot, out comes a portion of cream, and then the coffee—exactly a cupful. When your cup is filled, the mechanism automatically stops the flow of the liquid.

Virtually none of the cooking is done in the restaurants. There is a central bakery that supplies a dozen restaurants. The food is carried in huge automobile trucks to the various restaurants.



A motor pumps cold brine through the drum

Electrifying Water to Give It Sparkle

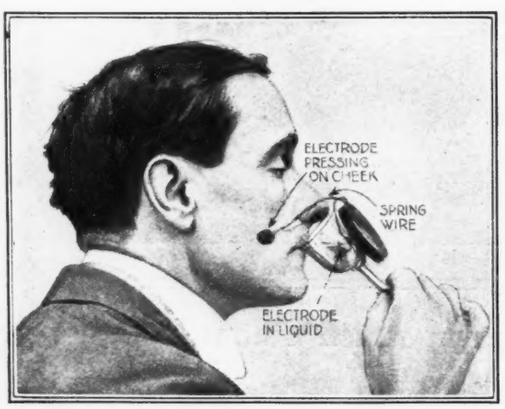
YOU can make plain water taste like champagne if you charge it with electricity while you drink it.

How is this done? The picture to the right shows a new electrical device for the purpose.

The apparatus consists of a small circular tank that contains an electric cell from which two electrodes extend.

One electrode is placed in the glass of water and the other is pressed against the drinker's cheek.

A slight current passes through the water and gives it a sparkle that is reminiscent of the days of sparkling wines.



If a slight electric current passes through water when you are drinking it, it will taste like old-time bubbly champagne

Wear Lead to Avoid Radium Dangers

THOSE who work with radium should wear lead armor and spectacles containing salts of lead, according to Dr. Béclère, one of the leading radium experts of France. Thus protected, radium operators will escape many of the dangers accompanying its use.

The injurious radium rays will pass through such substances as wood, but not through lead. Dr. Béclère also advises radium-users to employ instruments when working with radium salts; the salts should never be touched with the hands.

Radium has a ravaging effect on the marrow of the bones and on the spleen; its victim suddenly develops pernicious anemia, a disease that is almost impossible to cure.

Will a Ten-Mile Dam Change Canada's Climate?

Plugging Belle Isle strait might warm New England also

By Walter Noble Burns

The Gulf Stream, that beneficent body of water that comes up from the gulf of Mexico, blanketing the coast of the United States, when it reaches New England meets the cold Labrador current, which is strong enough to elbow it out into the Atlantic

Engineers are considering the project of plugging the strait of Belle Isle, between Newfoundland and Labrador, with a wall of solid masonry, and forcing the Labrador current back. This, they declare, would make the climate of Canada and New England like that of the Carolinas

THE strait of Belle Isle, a narrow channel separating Newfoundland from Labrador, is a hole in the wall of the Atlantic seaboard that is mainly responsible for the bleak winter climate of eastern Canada. Plug this hole, scientists declare, and eastern Canada and New England would have a climate as mild and delightful as that of the Carolinas.

Such a dam would cost about ten million dollars. It would require the placing of a solid strip of stone and concrete ten miles in length. The strip or dam would be about fifty feet wide and it would contain no less than 75,000,000 cubic feet of building material. This would be the equivalent of some 18,000,000 tons of stone and concrete. The railroad, which would be placed along the top of the dam, could be used to transport the materials, and it would be extended as the dam projected itself into the strait. The engineers might start operations from both shores and meet in the center.

Would Shorten Trip to Europe

A group of British capitalists have asked concessions from the Canadian government to build a railway from Quebec to St. Johns, Newfoundland. The road would run along the north shore of the St. Lawrence river and the gulf of St. Lawrence, cross the strait of Belle Isle by the dam, and traverse Newfoundland to St. Johns on its southeastern seaboard. British engineers have surveyed the route and reported on the feasibility and cost of the dam. The road would make St. Johns one of the great shipping points for Canadian export trade and would materially shorten the voyage to Europe. From St. Johns to Liverpool is a thousand miles less than from New York to Liverpool.

Canada has not yet announced its decision in the matter. Construction of the railway need not necessarily involve a change of climate. If a portion of the dam were built in the form of a bridge to permit the flow of water through it, there would be no climate transformation. To change the climate, the hole must be plugged tightly.

The dam would block the Labrador current from flowing into the gulf of St. Lawrence. The Labrador current has its origin in the Arctic ocean. Sweeping down from the frozen north through Baffin bay and Davis strait, it pours westward through the strait of Belle Isle to circulate about the gulf of St. Lawrence and bathe in frigidity all the shores and islands at that spacious arm of the sea. Passing out into the Atlantic again through Cabot strait, which separates Newfoundland from Cape Breton island, it turns southward and hugs the coast of Nova Scotia and New England.

The Labrador current is the dominant factor in molding the climate of eastern Newfoundland, Quebec, Prince Edward island, New Brunswick, Nova Scotia, and the New England states. It makes the summers cool and pleasant, but it adds to the already severe rigors of the northern winter. It affects not only climate but business.

With the dam obstructing its passage through Belle Isle strait, the Labrador current would be forced out into the Atlantic ocean. What would become of it out there is a matter of speculation. The pressure of water flowing up from the south, the engineers declare, eventually would force it in a giant curve back into the Arctic in the region of Spitzbergen. But its icy flood would no longer wash the shores of Canada and New England: the engineers say that, with the Labrador current diverted eastward, the Gulf Stream would swing in against the northern coasts.

The Warm Gulf Stream

After leaving the gulf of Mexico through Florida straits, the Gulf Stream turns northward and blankets the coast of the United States and keeps it warm till it reaches the latitude of New England. There it meets the Labrador current pushing south. The meeting is like that between a frosty old curmudgeon and some genial youth. The Labrador current holds frigid possession of the coast, and, turning a cold shoulder to the interloper from the south, elbows it out into the ocean. The Gulf Stream continues northward to Newfoundland, and finally shears off northeastward, carrying its burden of warmth to England and western Europe.

The Gulf Stream makes the climate of England what it is. Since climates mold the character of a people, their political fortunes, and industrial destinies, who will say that the Gulf Stream has not had a share in laying the foundations of the British Empire? Without it, at any rate, England would be as cold, and possibly as desolate, as Labrador.

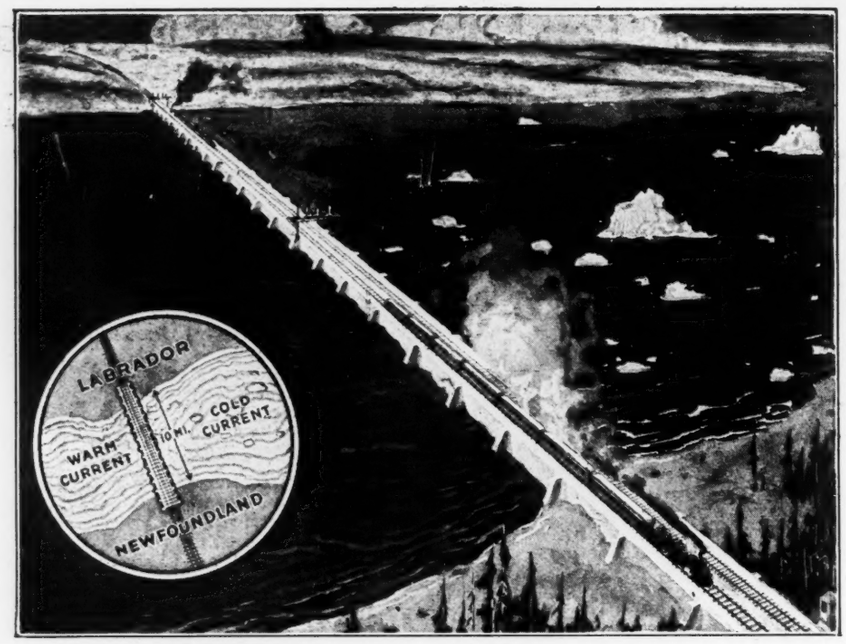
The engineers figure that, with the

Labrador current diverted eastward, the Gulf Stream would wash all the coasts of New England, New Brunswick, and Nova Scotia, and, sweeping through Cabot strait, bathe with its genial flood all the coasts and islands of the gulf of St. Lawrence. If, after a run of several thousand miles across the ocean, with icebergs melting along its northern rim, the Gulf Stream still has enough caloric to make the climate of such a northern country as England temperate and livable, how much greater would its effect be in ameliorating the climate of Canada and New England?

Will the Ocean Obey?

The scheme of the engineers sounds perfectly plausible. Replace one ocean current with another and—presto!—you have a new climate. But will these mighty ocean currents obey the behests of these human pygmies essaying to direct their courses? Will they "stay put"? Here the problem begins to cloud with skeptic doubts. What assurance is there that the Labrador current, blocked out of the strait of Belle Isle, would not flow down the eastern side of Newfoundland and gain an entrance into the gulf of St. Lawrence by Cabot strait? If the Labrador current, as the engineers say, should go off into mid-Atlantic and lose itself, is it certain that the Gulf Stream, in answer to the relieved pressure, would draw in its climate-transforming flood against the continent?

Then again, suppose it behaved exactly as the engineers say it would, would its diverted waters ever again find their way across the ocean to England? Is there not a chance that, while the Gulf Stream is replacing the Labrador current on American shores, the Labrador current, diverted eastward, would envelop the British Isles?



The tremendous project is part of a plan for the construction of a new Canadian railroad, which needs a bridge to connect Newfoundland with Labrador

While the climate of eastern Canada is being changed to that of Virginia, is there not a possibility that the climate of England would be changed to that of Labrador? These disturbing questions are answered by the engineers in the negative, but there are other persons not quite so sure. If the scientists ever had had any previous experience in juggling ocean currents, the situation might seem less enigmatical.

Granting, for the sake of argument, that the theory of the engineers would carry through, there is no reason to doubt that the climate of Canada would be tempered as far inland as the region of the Great Lakes. The effect of the Gulf Stream on the eastern coast would duplicate that of the Japanese current on the western. The Japanese current makes the coast of British Columbia a land of midwinter flowers, and distributes its largess of mildness on the wings of the chinook winds as far inland as the transmontane prairies of Alberta. Southern Alberta is in the same latitude as Montreal and Quebec; but, while the St. Lawrence river is locked with ice, cattle and livestock of all kinds are browsing in Alberta pastures and Alberta farmers are preparing their land for the summer harvest.

Changes that Would Arise

If the wall of masonry across the strait of Belle Isle would change the climate, it would also alter the agricultural and industrial destinies of eastern Canada. The fertile soil of Ontario, Quebec, New Brunswick, and Nova Scotia, already regions of teeming agricultural wealth, would become familiar with new crops. Vast areas now covered with primeval forests sweeping down from the northern hinterland would be cleared and transformed into farms. The value of the land in the maritime provinces and the valleys of the St. Lawrence and the Ottawa would be enhanced by billions of dollars.

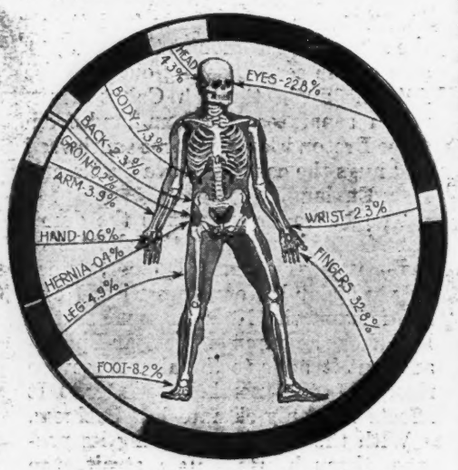
New industries would spring up to meet the changed conditions. New wealth would swarm in, seeking investments. Immigration would pour in. New cities would arise. Population would increase enormously. Canada would soon become a competitor of the United States in the markets of the world. Montreal would loom as the trade rival of New York and challenge the commercial supremacy of the continent.

Where We Injure Ourselves Most

THIS drawing shows the results obtained by a careful analysis of more than eighteen thousand injuries. It shows at a glance where we injure ourselves most. The hands and fingers are injured most, and this is natural, since we use our hands more than any other part of the body.

After the hands come the eyes—and this is more serious.

The body, extending from the shoulders to the trunk, receives only 7.3 per cent of the total injuries. The eyes represent only a very small percentage of the area of the body, yet they receive many more injuries due, in most cases, to flying particles in industries that use metal. Many of the accidents caused in this way have been prevented in the last few years by the use of heavy goggles.

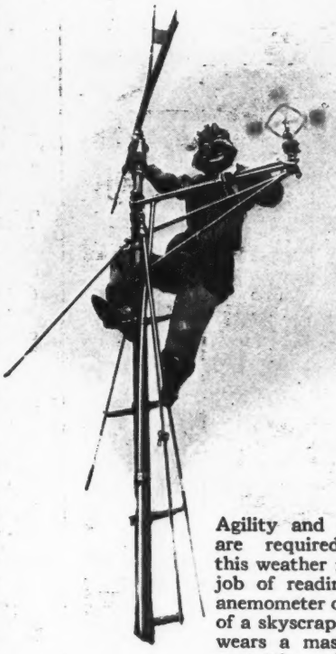


Vulnerable parts of the body. This diagram was prepared from a study of more than 18,000 accidents

The Climbing Weather Man

WHEN a young man enters the service of the government Weather Bureau, he is naturally possessed with a desire to rise in the world. This laudable ambition is promptly gratified. Not only are the offices of the Bureau commonly perched in the top stories of sky-scrapers, but the weather instruments that must be exposed to the elements are located at still higher levels.

A job that usually falls to the lot of the "cub" observer is that of watching the anemometer. This instrument, together with the wind-vane, is installed at the summit of a skeleton steel tower some forty feet above the roof. It consists of four hemispherical cups, the revolutions of which indicate the velocity of the wind. Although the anemometer is connected electrically with registering apparatus in the office below, the dial attached to the instrument itself must be read at intervals in order to check the automatic record. Moreover, anemometers need frequent oiling, and about once a month the regular instrument is removed for a thorough cleaning, an extra anemometer taking its place.



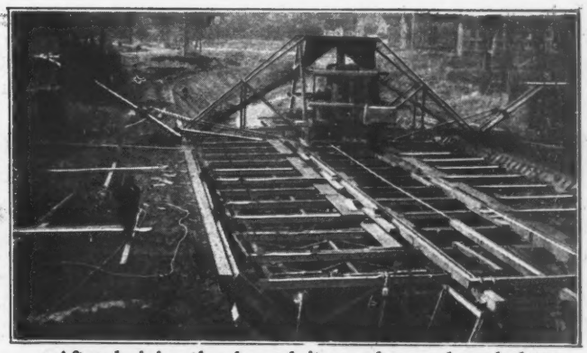
Agility and nerve are required for this weather man's job of reading an anemometer on top of a skyscraper; he wears a mask for protection against smoke

Both agility and nerve are required for these operations. The New York city anemometer is 450 feet above the sidewalk. In Chicago, though the instrument is not so high, it is located in close proximity to the mouth of a chimney that belches forth clouds of stifling smoke. Hence the Chicago weather man dons a gas-mask whenever he mounts the steel tower.

Are Foghorns to Become Obsolete?

ANYBODY living near a seaport who has suffered from the nerve-racking many-toned foghorns, will appreciate the equipping of harbors with wireless fog signals.

This has been made possible by the development of a new radio compass, by which a ship captain may determine his exact position instead of relying on whistles and foghorns.



After draining the channel, it was deepened, and the creek was lined with concrete by a traveling form

Lining a Creek with Concrete

FORMS were used for deepening and lining with concrete a creek channel at Syracuse, New York. The channel was deepened, after being drained by a walking drag-line excavator.

Five units made up the traveling form used for constructing the side walls. Mounted on double-flanged wheels, each unit was fourteen feet in length. Three rigid cross-braced trusses made up the individual units of the forms. Attached to arms, sliding with the upper and lower cord members of the trusses, were the steel faces of the forms against which the concrete was deposited.

The face forms could be moved horizontally to gain adjustments in desired positions. The movement and adjustment of the face forms was controlled by three jack-screws at each end of each truss.

He Tastes Radio Messages

HAVE you ever placed the wires from a dry battery on your tongue? If you have, you will remember that a peculiar "taste" was produced. This is often used as a test to determine whether or not there is any current left in a battery. The "taste" is caused by the electrolytic action of the current flowing through the moisture on the tongue.

For receiving radio messages in noisy places, two experimenters have evolved a method of reading radio by placing two electrodes on the tongue

Dr. Alfred N. Goldsmith and Edward T. Dickey have experimented with a system of radio reception, using this tasting effect of the electric current. The system is not proposed for commercial use, although it is possible that it may some day be considered seriously where receiving must be done in a noisy place.

The currents in radio receiving equipment are so weak that they would have no effect on the tongue.

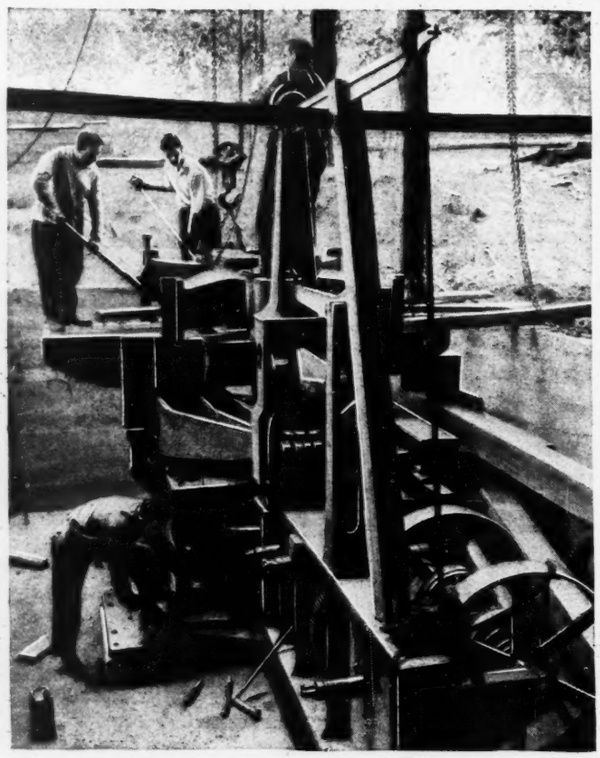
To overcome this problem, the experimenters used a vacuum-tube amplifier that brought the value of the current up to a point where it would cause the proper physiological effect. Two silver electrodes mounted on a piece of hard rubber are placed in the mouth. When these are laid on the tongue, the current flows across and causes the stinging sensation.

Chain and Padlock for the Shoe-Lace

SHOE-LACES may break, become knotted, or untied. The thought caused an Englishwoman so much worry that she could no longer enjoy her square-toed oxfords.

But she was not to be daunted! She bought two chains, two padlocks, and two keys. Ripping out her untrustworthy laces, she inserted the chains in their place. Next, she locked the ends together with her padlocks and added the keys to her key-ring—a simple solution of a difficult problem.

There is one objection to this system. The woman must have her keys in order to take off her shoes. Suppose she should lose the keys? Then she would have to send for a locksmith.



How Wood Is Tested for Strength

WOOD is still used in constructional work. While the engineer knows exactly the weight a steel beam of certain dimensions will sustain, he has very little data to help him figure the strength of wooden beams and rafters.

The United States Forest Products Laboratory has designed and built a machine that will test the tensile, compressive, and bending strength of wood. It is called a vertical screw-testing machine, and with it one is able to exert a pressure of one million pounds. It can test a beam or log thirty feet in length.

This machine will make available a mass of figures that will be of great benefit to the engineering sciences.

Steel and other building materials have been tested by special machinery for a long time, but engineers have just begun to turn their attention to the testing of the different woods. Some very interesting data have been accumulated.

The Oil-Saving Can with a Flexible Spout

OIL sells for eighty cents a gallon, and there is no use crying over spilled oil.

With the aid of this little can, which is equipped with a flexible spout, all of the oil used on the car may be put where it belongs instead of spilling it on the ground.

A flexible piece of metal tubing is soldered to the spout of the can and this may be used to direct the oil to any out-of-the-way bearing or otherwise inaccessible place.

The can holds two quarts, and there is no excuse for wasting a drop of oil when the flexible spout is used. A can of this nature has long been needed. All motorists owe the inventor a rising vote of thanks.

You Can Now Have Eyelashes to Order

THAT a few must suffer for the good of many has once more been proved. The beauty doctor shown below specializes in complexions. He injects color under the skin of pale-faced women, and makes them happy.

One day he tried out a new pigment. Alas! Hair grew on the spot where the pigment was injected!

The beauty doctor immediately branched out into the eyelash business. He injects that same pigment in the lids of women's eyes to-day, and has become famous as an eyelash-grower.

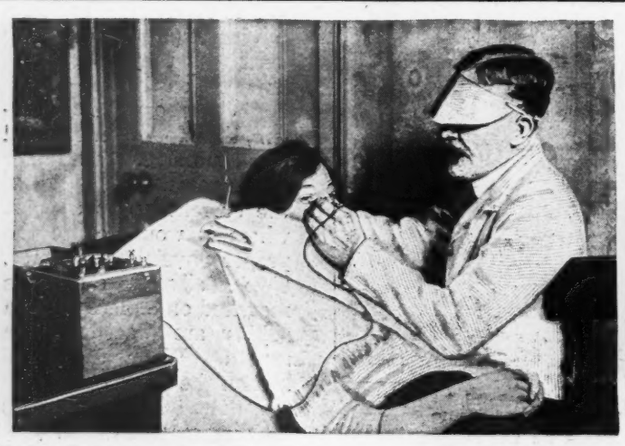
It is to be hoped that the purveyor of beauty was able to help the ladies who were the sufferers in this otherwise successful experiment.

Ironing without Touching the Iron

IRON with your feet; they do not tire as rapidly as your hands. But how can this be done, you ask.

There is now an electric ironing apparatus that not only heats the iron, but moves it back and forth across the ironing-board; you merely step on a foot-pedal to start the iron in motion. With your hands you guide the cloth, much as you do when you are using a sewing-machine.

Of course, an iron of this sort can be used only on laundry pieces that are nearly or quite flat. For example, you could not iron a blouse or ruffled summer dress with this mechanical iron. Besides, it is a factory machine, which can be profitably installed only when square miles of fabric are to be ironed.

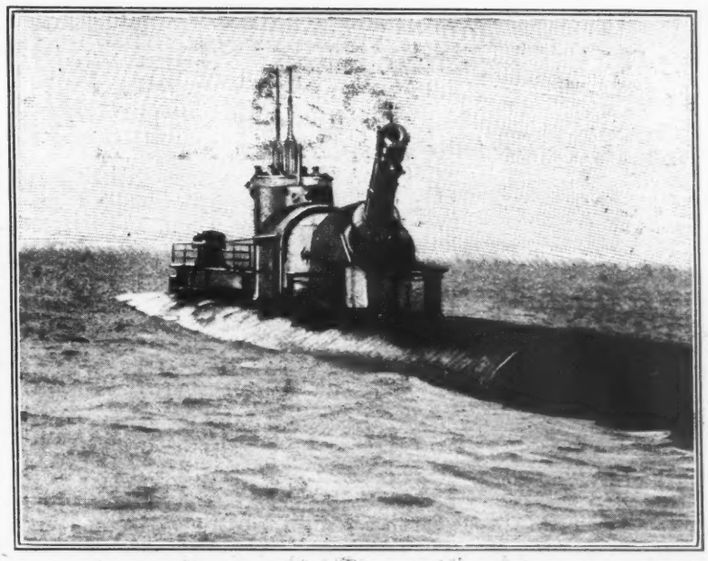


How to Keep the Golf-Ball Clean

A GOOD clean white golf-ball is a ball that can be seen easily. It is especially useful for poor players who are not able to keep the ball on the green. When it gets into the deep grass it can be seen very easily.

Below is a little golf-ball cleaner that will fit in the vest pocket. A small sponge is first used to wet the ball. Then it is pressed on and revolved against a small rubber mat that is contained in the other half of the container.

This little device will make a welcome addition to any golf-player's outfit, as a clean ball is always more easily seen than a dirty one.



The Largest Submarine Carries a Twelve-Inch Gun

THIS is a new British battleship of the deep. She is certainly a wicked piece of fighting steel with her twelve-inch gun.

The gun is one that can be used for "all-around" purposes. It can be elevated to fight off airplanes, or it can be leveled at another submarine. The outer surface of the big gun is made waterproof and the muzzle is tightly plugged before the ship submerges.

The largest gun carried by a United States submarine has a three-inch bore.

The gun of the British boat may be fired while the deck of the vessel is submerged. It is necessary to leave only the periscope above the water. The new vessel is two hundred feet long and twenty feet wide.

The mounting of guns on submarine decks greatly interferes with the speed of the craft. In fact, every object on the deck offers resistance to the movement of the vessel when it is under water. But what is lost in one way is gained in another. Guns on the deck of a submarine heighten its ability to protect itself and to offer assistance to the fleet during conflict.

One advantage of the smaller gun is that it can be made to disappear into the deck when the vessel is ready to submerge, thus enabling the submarine to attain its highest speed, either away from retaliatory danger, or to a more advantageous spot to continue its attack upon the enemy.

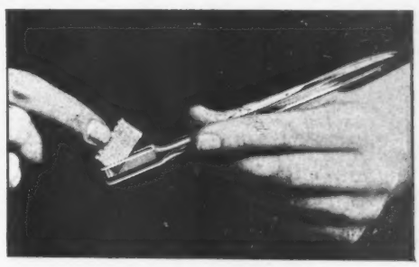
A New Toothbrush Every Day

IN toothbrushes the latest idea provides a new brush every time you wash your teeth.

In the new invention the handle and the brush come separately.

The brushes, made of a vegetable fiber, come joined together, wrapped in a sanitary package. The user breaks off a brush as often as he has need of one, and fits it into a depression in the handle. After once using, the brush is thrown away.

Besides the enormous advantage of cleanliness, its makers claim for it that the short bristles and small size of the brush enable it to reach every part of the teeth with ease.

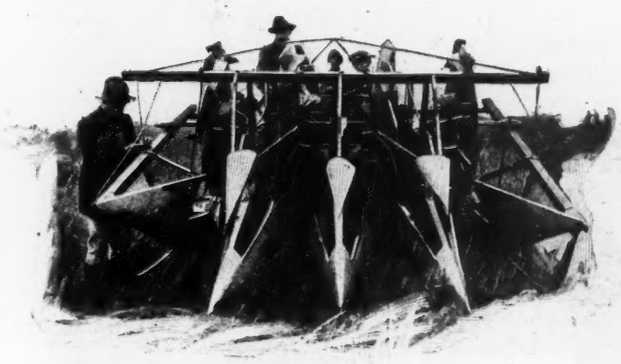


Harvesting Sweet-Clover Seed

FROM Springfield, Illinois, comes a man who has invented a machine for harvesting sweet-clover seed, without cutting the plants, in the field. One man drives while another tends to the screening and sacking.

The machine is carried by two wheels, while the end of the tongue is supported by a caster wheel to facilitate turning at corners.

A chain sprocket on the large axle drives an overhead shaft bearing four large paddles or threshing-wheels. Parting guides compact the stalks as they are drawn through fin-shaped paddles. These notched paddles mesh loosely. As the stalks are drawn through, they are bent into angles while the seed is beaten off. The seeds drop into conveyors that carry them to a bin. A swath nine feet wide is covered by the machine.



Gather Corn the Cheaper Way

MOST farmers know what an expensive matter harvesting corn is, with the cutter and blower at the silo and the harvester in the field.

I. J. Mathews, of Indiana, has adopted another method, one that effects a saving of forty cents a ton on his corn crop. He attaches a corn-harvester to a cutter, the whole being run by a gasoline engine. The stalks are taken up by conveyor chains and fed to the cutter with the butts first.

After the corn is cut, it is fed to a wagon. With this combination of harvester and cutter, trips to the silo need not be made as frequently as in the old way. This allows the corn in the silo longer to settle and thus permits larger deposits of grain.

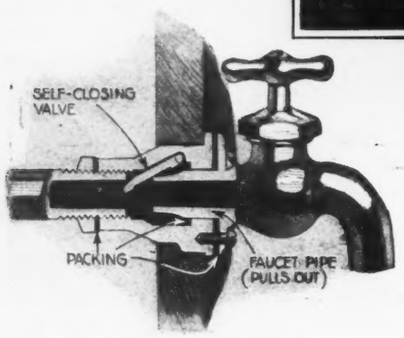
Three horses are required to draw this outfit over the field.

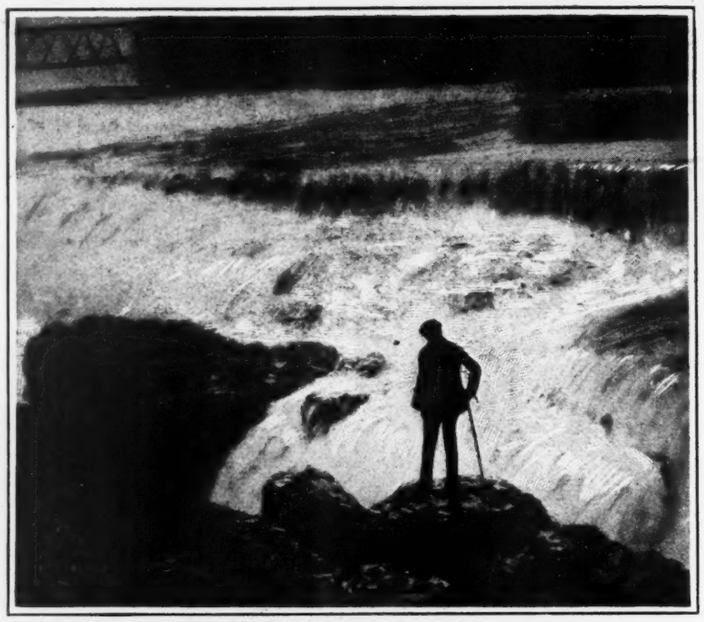
Making the Repair of Faucets Easy

GREAT excitement pervades the house when a faucet cannot be turned off. There is much hurrying to find the water-valve in the cellar. Then, when this is accomplished, the entire house is waterless.

A French inventor uses a faucet that automatically cuts off the water when it is removed from the pipe. The end of the faucet rests against a small trapdoor in the pipe. When the faucet is removed, the door is left free to close and the pressure of the water at the other end keeps it in place.

The water is automatically turned on when the faucet is repaired.





Where the Passaic River Flows into a Crack

THE Passaic river, near the silk-mills in Paterson, New Jersey, was once considered as a possible source to furnish one hundred million gallons of water a day to New York city.

An enormous amount of power is generated at the Paterson falls. One curious feature that makes this waterfall different from others is a geologic peculiarity. Flowing northeast, the river appears to end suddenly. A close view shows that it turns abruptly toward the south and pours into a deep crevice in the basaltic rock. There is a sheer fall of seventy-two feet, and a part of the chasm into which the water pours is only five or six feet across. During the flood season a force of some two million tons is hurled daily at the basalt obstruction.

Dried Caterpillars as Food

INDIANS in the Mono lake district of California regard as a great delicacy a certain species of caterpillar, which they call "pe-aggie." They dig trenches around the base of trees, the vertical sides of which prevent caterpillars that stray in from getting out.

After gathering quantities of the caterpillars, the Indians dry them in hot sand. Then the sand is removed, and the caterpillars are spread on the ground for two days; after which they are kept in sacks until needed.

J. M. Aldrich, of the United States National Museum, has partaken of the "delicacy," and does not regard the flavor so highly as do the Indians.

You Can Carry this Washer in a Trunk

ONE glance at the picture below will inform you that the six-pound electric washerette has arrived, made especially for those who live in kitchenette apartments. Its operation is done with little noise, and it can be placed in a bathtub or across a kitchen sink or wash-bowl.

The washerette has been designed to meet the demand for a small washer that will not injure delicate fabrics, such as fine blouses, silk stockings, and undergarments, as well as all articles of baby's clothing.

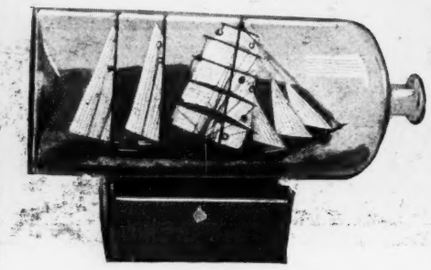
The machine is driven by a small water-motor. It is necessary merely to turn on the water and watch it work.

How Did the Ship Get Inside?

MANY of us have seen ships in bottles. But that is not the interesting point. The point is. how did the ship get in the bottle?

It is no great secret. Contrary to the general belief, the bottle was not blown around the ship. No; the patience of a very careful workman is required.

First, he cuts out the necessary pieces to make his ship, then he inserts them into their proper places in the bottle. In fact, the ship is built up inside the bottle with the help of tongs and tweezers. The sails are first inserted in the bottle and are then pulled erect by strings.

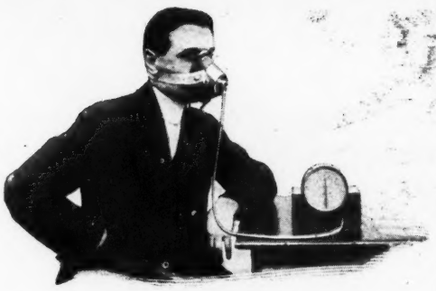


Bayonets Make Good Wood-Cleavers

SINCE there is no military use for the sword bayonet now, inventors are exerting their ingenuity to convert it into a useful and harmless implement.

The accompanying illustration shows an ingenious attachment produced from a sword. It is a wood-cleaver, which a German firm recently exhibited at the Frankfort fair. The sheath comprises a number of notches for holding the sticks, the sword being fixed in hinges at one of its ends.

It is an excellent device for chopping wood, there being no risk of harming one's fingers. The wood-cleaver is screwed fast to a table or a chair.



Respiration Is Measured with This Apparatus

THE muzzlelike mask worn by the man in the picture is an apparatus invented by Dr. J. L. Pech, a French practitioner, for measuring with exactness the volume of air taken in and expelled during the process of respiration. He believes that the instrument has as much diagnostic value as the stethoscope.

The mask, which can be thoroughly sterilized, consists of a metal cone, shaped to fit over the nose and mouth. Airtight contact is insured by an elastic cushion of rubber.

The metallic cone is a one-way valve, through which the air enters, and is connected with a manometer by means of a rubber tube.

Mothering 1500 Chicks

A BROODER that gives chicks just the amount of heat they need is shown below. The fuel, a low-grade petroleum oil, is kept in the tank at the top of the heater. As many as fifteen hundred chicks may find comfort and warmth around this stove at one time.

The brooder keeps them at the temperature a mother would keep them if their mother had been a hen and not an incubator. The temperature of a hen is about 106° F., but it has not been found necessary to keep the temperature as high as this in the brooder coop.

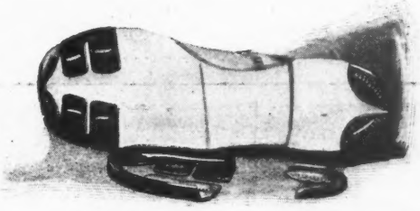
A uniform temperature is maintained automatically by a water-regulator that controls the flow of the oil from the tank to the burner.

Getting More Wear Out of Shoes

SHOES do not wear as long as they should, especially workingmen's shoes. Metal shields will prolong the useful life of shoes, but most persons do not like the noise they make when they come in contact with the pavement. There is a distinct click, click, click that is not pleasant to hear.

However, if the wearer is willing to overlook the disadvantage of the noise, these iron shields will certainly add several weeks at least to the life of his shoes.

The shields protect the parts that are sure to wear out first—the front of the sole and the heels. They may be bought for a few cents and they are attached to the shoe with very little trouble.



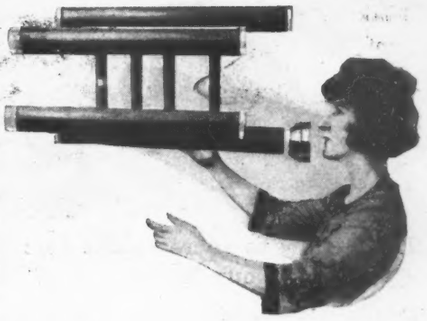
No More Arguments About the Dish-Washing

CONNECT this dish-washer with the faucet and let it do your dish-washing for you. This will do a lot toward saving time, so that the household members can get to the movies in time to see the first show.

A small water-motor is arranged inside the device, and this whirls two nozzles around, spraying the dirty dishes with clean water.

The dishes are held in a wire tray above the whirling nozzles, the water reaching every dish.

It is claimed for this washer that dishes for a family of six can be washed in three minutes, after being given a preliminary scraping.



You May Hear Yourself as Others Hear You

HEAR yourself as others hear you; this is a good motto for would-be elocutionists. And it can easily be done by means of the ladderlike device shown above.

As the woman speaks, her voice rumbles through the various tubes and comes out through one of the tubes above her. Not only is her own voice plainly heard, but it is also amplified so that all the defects in her pronunciation stand out. The tubes in the case are made of cardboard and are sealed at the closed ends with paper.

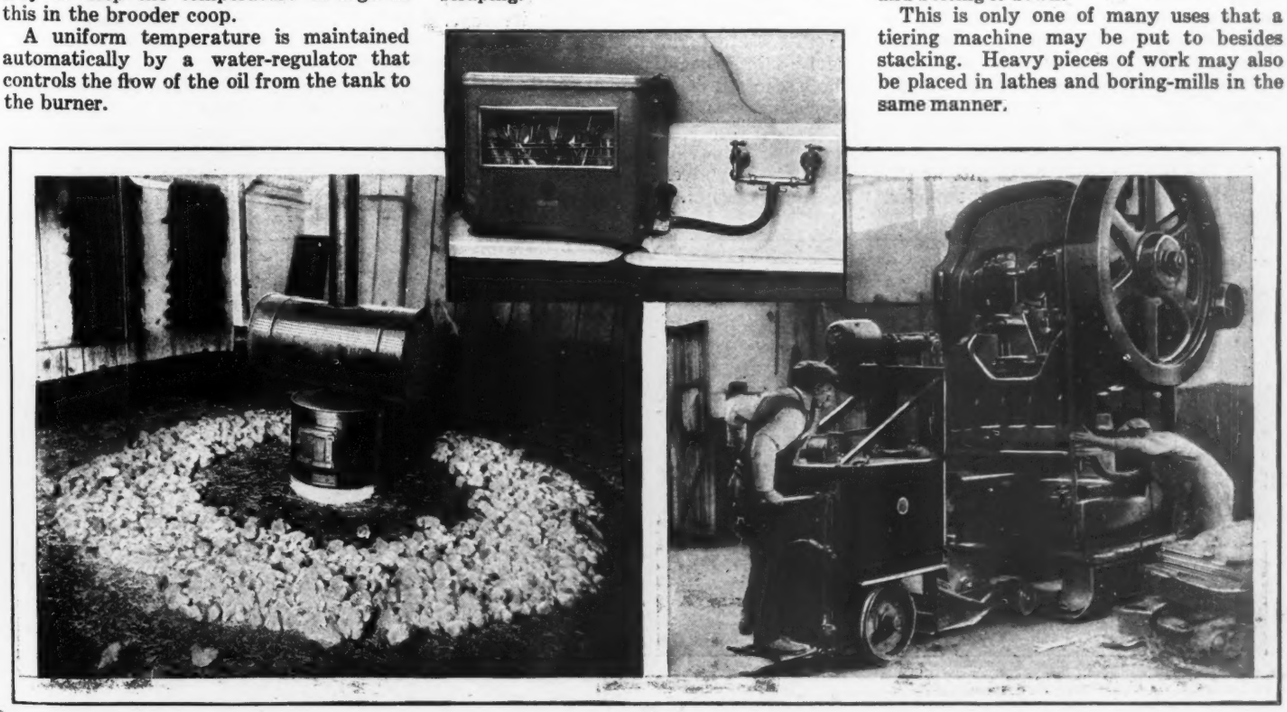
This device simply projects your voice into space and then brings it back again to your ear. It is a mechanical echo.

A Tiering-Truck Becomes a Hoist

BELOW is shown a clever stunt of a machine-shop foreman. A small electrically driven tiering-truck is pressed into service in placing a heavy die on a large punch-press. The die weighs several hundred pounds, far too heavy for the men to lift.

The truck is called into use and the die is loaded on to the platform. The motor is switched on, and up goes the die to the level of the press. Then it is simply a matter of sliding the die under the punch and bolting it down.

This is only one of many uses that a tiering machine may be put to besides stacking. Heavy pieces of work may also be placed in lathes and boring-mills in the same manner.



Learn How to Increase the Life of Your Shoes

FOLLOW the simple formula below and you will be able to cut several dollars off your shoe bill this year.

The use of oil or grease not only makes leather wear longer, but it renders it softer and more pliable. When leather is softened it is not so apt to crack. A properly greased shoe is also waterproof.

Before shoes are oiled or greased, they should be carefully brushed and warmed in an oven for a few minutes.

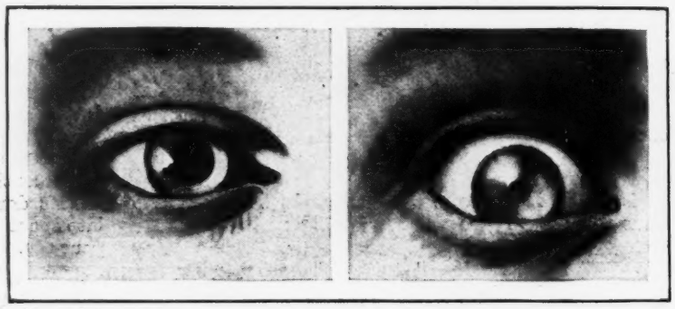
To apply the warm oil or grease, use a cotton swab or a soft piece of flannel. Then rub the oil well in the leather with the palm of the hand, taking special care to work the grease into the seam where the sole is joined to the upper.

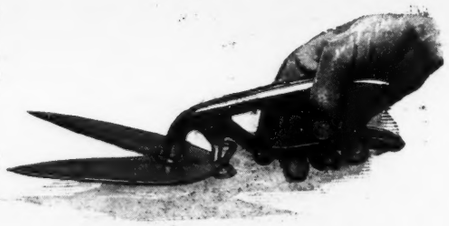
Tallow or wool grease are useful for this purpose.

How Glare Fatigues the Eye

IF more people could be made to realize the value of correct illumination, opticians would not be so busy doctoring abused eyes. Look at the photograph below showing eyes under proper illumination and under direct glare. Note the difference. Notice the shrinkage of the pupil of the eye subject to glare. The condition of the entire eyeball is abnormal. The other eye appears rested and normal. This comes from the proper diffusion of light by the indirect method of illumination.

The proper diffusion and distribution of light in a room is brought about by the use of the proper kind of a reflector. With indirect illumination the light is first reflected against a white ceiling and from this it is reflected into the room. This prevents a concentration of the rays.





Would You Take the Blisters Out of Grass-Trimming?

MUCH as a man may enjoy and feel a pride in taking care of his own house and grounds, anything that will help to take the hard work out of cutting the grass and keeping it in order is certainly welcomed by him if it is his lot to keep the grounds looking right.

After the lawn-mower is used, it is always necessary to apply the grass-shears in order to get into the corners that the clumsy lawn-mower can not reach, also to trim the edges, and of course bushes and hedge.

That is where these new shears came in handy. They are made to fit the human hand, unlike most of their forerunners. They prevent fatigue and painful blistering and they cut the grass just as well as the uncomfortable kind.

Making the Air Propeller Smaller and Faster

SOUND waves travel at about 1100 feet a second. Here is a new type of propeller that can be driven at a tip speed of 1500 feet a second. The sound it produces is far higher in pitch than that of any airplane propeller, and its tip speed is higher than has ever been attained experimentally, the previous record being about 900 feet a second. Beyond that speed the propeller ordinarily loses its efficiency and ceases to exert any thrust, or "pulling" force upon the air. With this aluminum model at a tip speed of 1500, representing a shaft velocity of 7200 revolutions a minute, there is a pulling force or "thrust" of 200 pounds.

The new propeller is the invention of S. A. Reed, an expert mechanical engineer, who is conducting his experiments at the Curtiss plant. When the tip speed of a propeller reaches 1000 feet a second, its centrifugal speed is 16,000 times the weight of any object at its tip. Every particle of the material at its tip is thus tending to be hurled out at a pull equal to 16,000 times the weight of the particle. This means a tension of about 1000 pounds on the propeller, tending to stretch it out straight. The motor used in the experiments developed 100 horsepower.

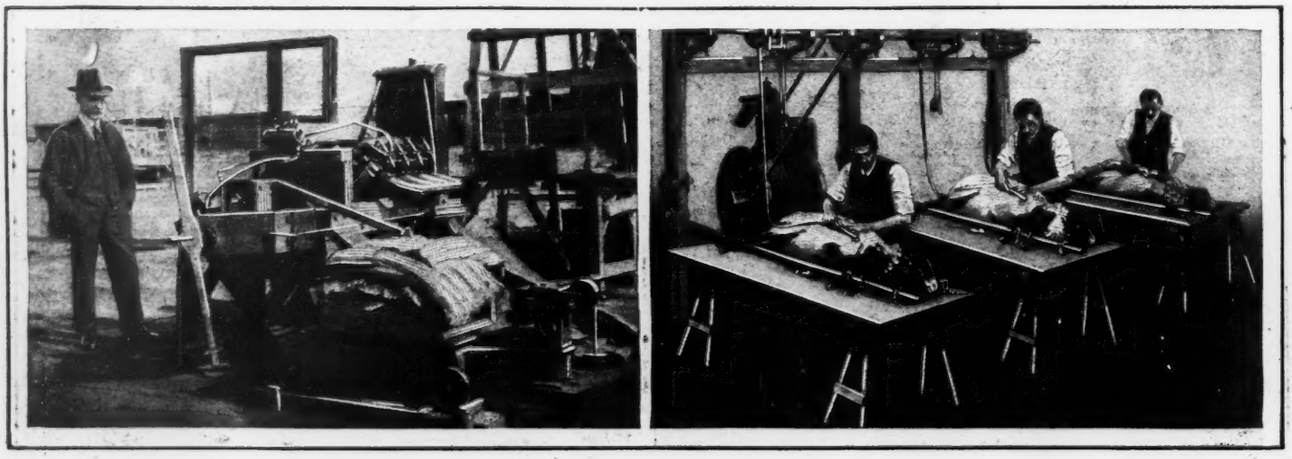
The propeller is four feet in diameter, and is very thin and sharp at its edge. From these experiments it is expected to devise a propeller of suitable material half the size of those now in use. To obtain high speed from the engine without the use of reduction gears, thus to make use of the engine at its best speed, is the ultimate end in view. This invention can also be applied to marine engines.

Sheep Under the Electric Clipper

WHEN sheep are shorn by hand with scissors, they are frequently injured. By employing an electrically driven clipper, the animals are spared pain and injury, and the wool is removed more evenly and more rapidly than could be done by hand shearing.

The illustration shows the method employed in the shearing. The sheep is placed on a table resting on trestles and the feet of the animal are strapped to a stationary rod provided for that purpose, so that it cannot roll over or make any other motion that might interfere with the work.

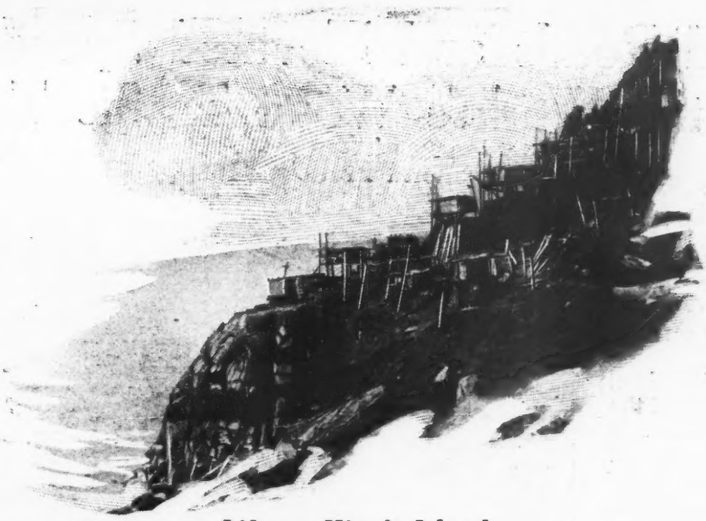
The clipper, which is similar in construction to that used by barbers, has a number of cutters arranged like the teeth of a comb, and obtains a rapid oscillating movement by an eccentric gear driven by a small motor.



When a Blaze Starts the Bell Rings

FIRE-ALARMS must function without fail. Let the temperature of a room reach 165 degrees and this fire-alarm will attract attention by its noise.

The device is controlled by a small fusible link made of a metal that has a very low melting-point. Melting at low temperature sounds the alarm, and enables those present to catch the fire before it has reached a dangerous stage. It may be used again by simply inserting another fusible link. These links are so accurate that the government has used them to test thermometers.



Pull the Trigger from the Inside

ONE inventor at least is going to give the bandit a run for his money. This automatic pistol, which has been invented by a member of the San Francisco Fire Department, is held under the armpit, and it may be fired without any suspicious move on the part of the person held up.

A small flexible shaft runs from the trigger down the inside of the coat sleeve. A button is placed at the end of the shaft, and when this is pressed with the fingers, the gun explodes. It is a sure-fire arrangement and a deadly aim may be made at close range.

Life on King's Island

THE Eskimo inhabitants of King's island, a rocky cliff that rises above the surface of North Behring sea, build flimsy-looking structures balanced on poles and walled with skins, for their living-rooms. They sleep in holes burrowed in the rock.

United States coast-guard officers have found the huts warm even when the mercury registered below zero.

Cotton from Airplane "Dope"

THE heavy coating of varnish, or "dope," on airplane wings contains what might be called "liquid cotton." To prove this, one can take a little of the dope in a test-tube and pour into it an equal amount of water. Immediately the cotton begins to form. It appears in natural fibers that can be taken out of the tube and woven into a fabric, or made into thread.

Unless the fabric of the wing is absolutely dry when the liquid is put on it, the cotton will have a rough surface. The nitrated cellulose suffers a rapid reaction from water. Until it is thoroughly dry moisture must not reach the coated wing-surface.

Cotton is seen forming in the center of test tube as water is poured in.

Langley's First Flying-Machine

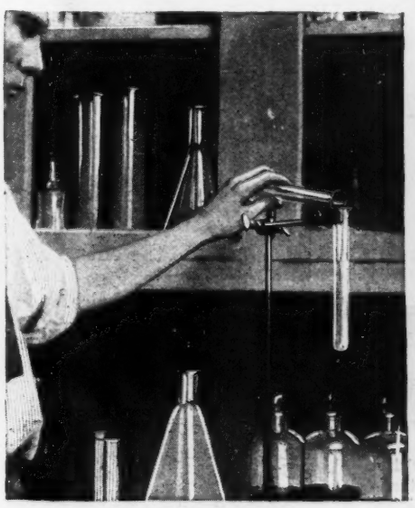
IN the model-room of the Curtiss airplane factory at Garden City, Long Island, are many interesting miniatures of flying craft. Not the least so is that of Professor Langley's first aerodrome, the replica of his first model which actually was flown with mechanical power. A. L. Thurston, who holds the model, has been responsible for many improvements in modern aircraft.

Note the propeller in the side of the model. It was shaped to propel the craft through the waves of the air much in the manner of a "side-wheel" of an ancient river boat. It was this crude pioneer that inspired the Wright brothers to continue their own experiments.

Making the Gas-Tank Safe

A BULLET-PROOF gasoline-tank for airplanes has not yet been devised, but here is a tank into which numbers of machine-gun bullets can be shot without danger of the gasoline leaking out sufficiently to bring the airplane down in flames. The metal tank is covered with a jacket made of three-ply rubber. On the outside are several thicknesses of closely woven canvas. When a bullet cuts its way through the tank, the rubber automatically closes up the hole.

There has, however, been devised an incendiary bullet containing phosphorus that undoes the complete utility of the rubber cover. It is now up to somebody to offset the effectiveness of the new bullet.



Underground Roads and Elevated Speedways May Solve the World's Worst Traffic Tangle

By Raymond Francis Yates

APPROXIMATELY one third of the half million motor-cars in New York state are registered from the city of New York. One hundred and sixty-five thousand cars roll along its streets every day.

New York's traffic problem is a peculiar one. The greater part of the city, the busiest part, at least, is located on the long, narrow island of Manhattan. There are a great number of crosstown streets on the island, but very few up- and down-town streets. In fact, the busiest part of Manhattan has only fourteen up- and down-town streets. Traffic on four of these streets is interfered with by the presence of elevated railroads and street-car lines. The steel pillars of the elevated road structures greatly impede the progress of street traffic.

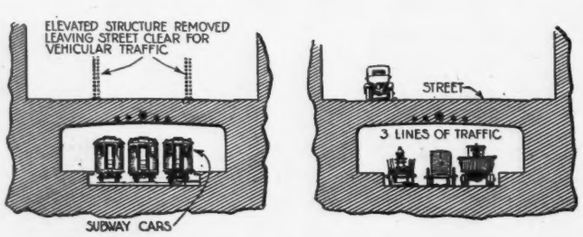
During the rush hours of the day the north-and-south (up- and down-town) traffic is barely manageable. The main arteries are crowded to the limit and, with the present facilities, in a few years' time it will be absolutely impossible to keep them clear. Something will have to be done. Although the new block system in use has done a great deal to alleviate the traffic conditions, the problem is not solved.

Illustrating Commissioner Enright's suggestion to convert Ninth, Sixth, and Second avenues into speedways, to be used for one-way traffic during the rush hours

Commissioner Enright's Plan

The widening of the streets has been considered, but, after a careful analysis of the present conditions, it was decided to abandon the idea. Police Commissioner Enright has suggested the plan that is roughly outlined in the sketch of Manhattan shown. He suggests that a speedway be built from Seventy-second street to the Battery along the west side of Manhattan island. This would be either an elevated or a subterranean thoroughfare, and it would probably take its course along the present Ninth avenue. The Sixth avenue elevated structure would also be eliminated between Third and Fifty-ninth streets, and this thoroughfare would then be changed into a speedway. Second avenue, which runs up the east side of the island, would be changed to a speedway. This would make three main arteries for traffic that would not be interfered with by vehicles bound across town. It is the crosstown traffic that prevents the free movement of uptown and downtown traffic at the present time.

Fifth avenue is badly congested all the day, and especially during the morning and evening rush hours. In the evening it is almost impossible to handle the flood of vehicles. Broadway and Park avenues get their share of the traffic during these hours, at which time they are crowded to capacity. The establishment of other routes that would offer unrestricted movement would relieve these three streets of the present strain. If traffic could be distributed evenly between the fourteen streets that now run up- and down-town, the problem would not be quite so serious as it is now. Elevated structures on four of these streets prevent this, and it is natural that the vehicles take the central routes. If these elevated railroads were eliminated from the surface and subways built in their stead, the streets could be given over to the entire use of vehicular traffic.



This shows how elevated railroads could be replaced by subways, thereby giving the street over to vehicular traffic. The sketch at the right shows a subway for vehicles

Dr. John Harriss, New York's Deputy Police Commissioner who installed the tower signal system on Fifth avenue, has made a new suggestion about handling traffic that is being considered very seriously.

Sixth avenue, which already

boasts of trolley-cars and an elevated railroad, has been selected by Dr. Harriss as a street in need of a second story. He suggests that a viaduct be built, starting at Fortieth street near the entrance to Bryant Park, and extending to Central Park at Fifty-ninth street. It will be on a level with the elevated railway and will accommodate both automobiles and pedestrians.

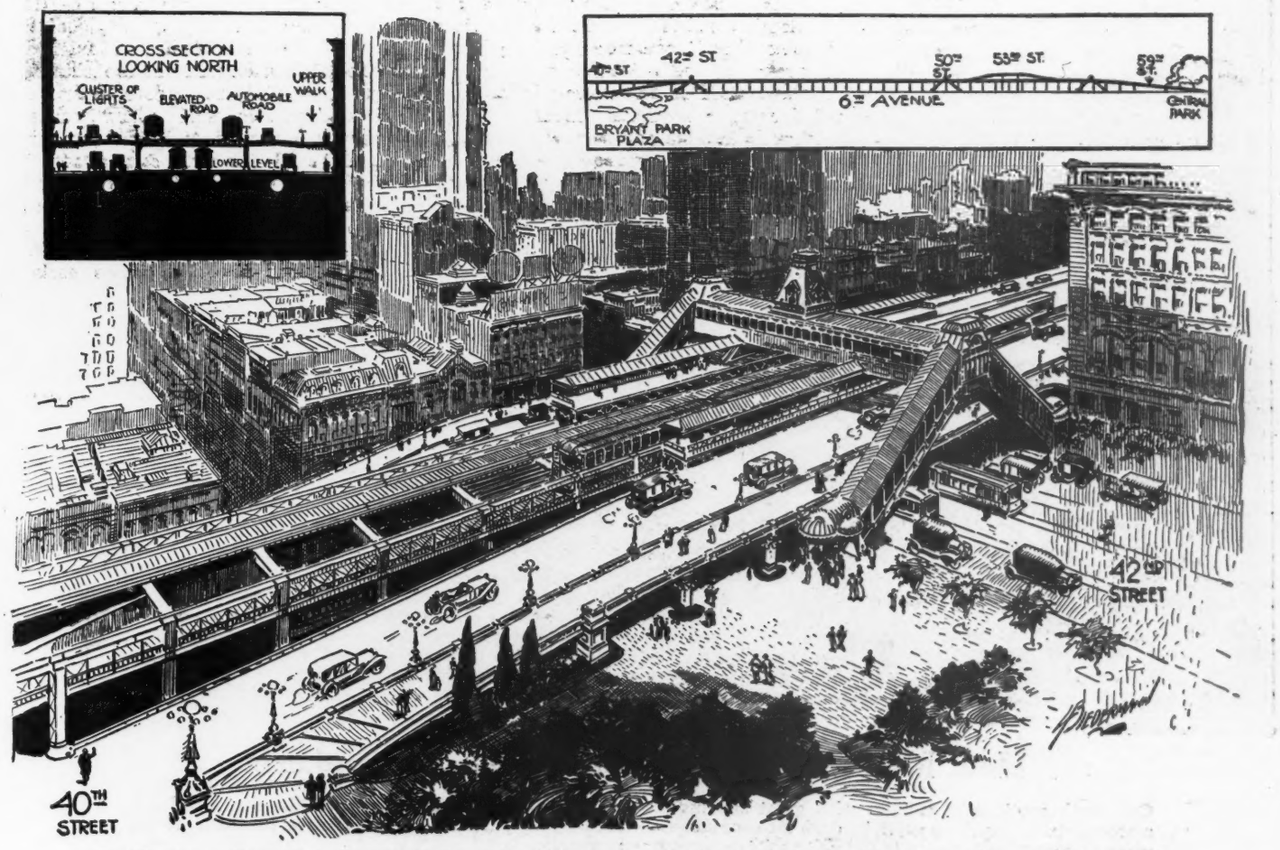
This is the way the Sixth avenue elevated railroad would look if the tracks were eliminated and pavement laid on the surface. Such roadways would be used for down-town traffic in the morning and for uptown traffic in the evening

Some Statistics

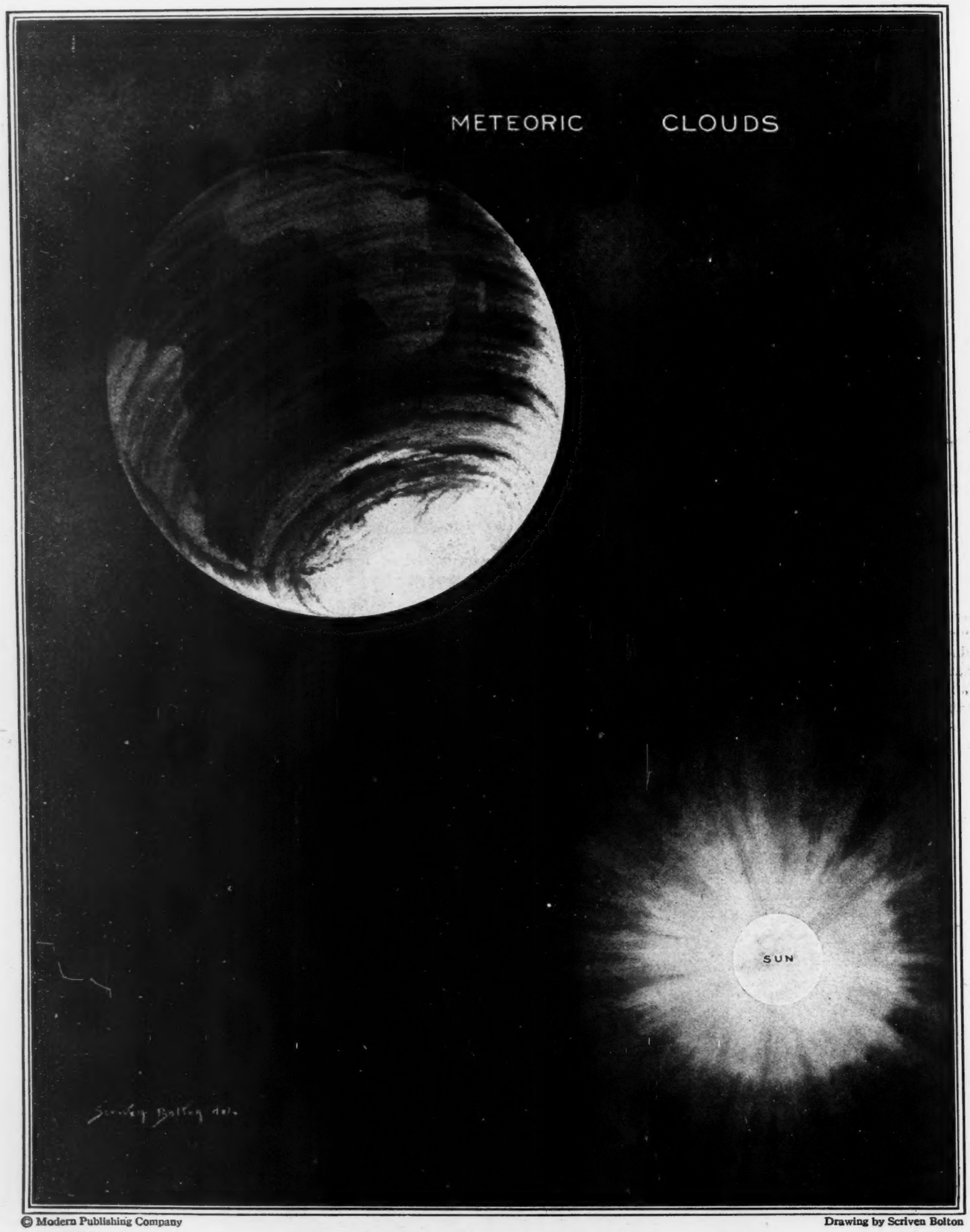
It is feared, however, that property-owners will object to the building of such a viaduct, believing that it will injure their business. Dr. Harriss, on the contrary, thinks that it will do more good than harm. There is a space of forty feet on either side of the railway tracks, and this will be divided into a roadway and a sidewalk. A second-story entrance to the stores located on this street could be built on a level with the sidewalk.

In regard to this traffic problem, Mr. D. L. Turner, chief engineer of the Transit Construction Commission, says: "There are only about one hundred miles of up- and down-town streets to serve about three hundred and twenty-five miles of cross-town streets. There are only eleven through up- and down-town thoroughfares to serve approximately one hundred and fifty cross-town streets. In other words, there are nearly fourteen cross-town streets to one up-and-down street."

Mr. Turner has put the situation into figures, always more dramatic than mere words. With such a condition as he portrays, something will have to be done. Whether it be Commissioner Enright's plan that is adopted or that of Deputy Police Commissioner Harriss, or some other yet unheard-of solution, New York will have to do something, and not be too long about it.



Dr. Harriss, a New York Deputy Police Commissioner, would place this elevated street along Sixth avenue. This would parallel the elevated railroad on each side, and it could be arranged at the same height. Such a structure would practically double the traffic capacity of this avenue. It would extend from Bryant Park at Sixth avenue and Forty-second street to Central Park at Fifty-ninth street



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Drawing by Scriven Bolton

How Meteoric Dust Gets into Our Atmosphere

Our earth continually collides with great swarms of meteoric dust. As these particles dash into our atmosphere at a speed of from ten to forty-five miles a second, they are immediately reduced to powder by friction with the earth's air, becoming visible as the particles are burnt at a height of from fifty to seventy miles. Thus we see the shooting star.

This powder charges the upper air with cosmic dust, which ultimately settles down on the earth. This is actually in part the "dust" that is the bane of the housewife.

It is estimated that about forty million particles, or meteors, become entangled in the earth's atmospheric net every day, and that, ground to powder, these add to the earth's load two hundred tons in every twenty-four hours

Two Hundred Tons Added to the Earth Daily

Shattered comets shower our planet with dust

By Scriven Bolton, F. R. A. S., M. B. A. A.

THERE is not a spot on this globe that has not yielded what the housewife calls "dust." It is found settling alike upon the white polar snows and on the Sahara desert, as well as on the decks of ocean-going ships.

The earth is continually colliding with great swarms or clouds of dust and small particles, ranging in size from a pin's head to a walnut.

In dashing into our atmosphere with a speed of from ten to forty-five miles a second, they are immediately rendered incandescent, and reduced to powder through friction with our air. This process of dissolution produces the shooting star or meteor. Thus the debris, or powder, resulting from the continual destruction of these masses, charges the upper air with cosmic dust, which ultimately settles down upon the earth.

What Happens to the Dust

The upper layers of our atmosphere are accordingly being continually charged with magnetic meteoric dust, which forms a continual addition of material—about two hundred tons daily—to the earth's load. It is estimated that about forty millions of particles, or meteors, become entangled in the atmospheric net every day and are ground to powder.

An incalculable number of particles, of both organic and inorganic origin, are held in suspension in our air. Attempts to detect meteoric dust that settles on the general surface of the ground are virtually useless, owing to the usual presence of contamination. Cosmic stony and metallic particles, however, are discovered in abundance in the bed of oceans, since the process of slow deposition continues uninterruptedly.

These great dust shoals that the earth incessantly encounters are believed to be the debris of disintegrated comets. They have well timed tracks round the sun, and are distributed completely along their orbits, thus forming great ellipses round the sun. Hence the earth, in crossing these paths on fixed dates every year, encounters these swarms.

Mutual attraction alone holds together these huge dust-clouds, which are so very tenuitive that the gravity of the planets remains undisturbed, and they become visible only as the constituent particles are burnt up in our atmosphere at a height of from fifty to seventy miles.

The splendor of twilight is attributed in part to the presence in the air of solid particles and dust in question. Twilight is nothing more nor less than a reflection of the sun's light by atmospheric vapors, and the dust particles in suspension. The outer layer of our atmosphere must be greatly charged with this fine cosmic dust, and the afterglow appears to be greatly increased by the precipitation of moisture on these particles as night approaches. The fact that the earth encounters great shoals of dust in October and November gives rise to the splendid afterglows in these months.

Is the Aurora Borealis Made of Dust?

This meteoric dust is composed chiefly of iron, magnesium, manganese, carbon, nickel, copper, sulphur, phosphorus, lead, thallium, and various silicates. Now, the spectrum of meteoric dust is practically coincident with that of the aurora, or the Northern Lights. Evidence appears to show that the aurora finds its sole origin in this dust, which is of a magnetic nature. It is stated on the highest authority that a display of the aurora signifies a shoal of dust particles traveling at a tremendous rate through the upper part of our atmosphere.

What Is the Scoresby?

AN instrument known as the scoresby is used at the United States Naval Observatory at Washington for teaching future navigators how to compensate for the deviation of the compass. This deviation is caused by the steel and iron in the whole structure of a battleship.

The scoresby consists of a compass and binnacle set on a pivot so that the magnetic bearing of an artificial sun, which is a part of the apparatus, remains always the same. The "sun" is an electric light, in a circular frame, near the ceiling in a corner of the instruction room. Its beams fall directly on the instrument. The compass and binnacle are mounted on a support that can be revolved on a track to any position corresponding to a new direction in the ship's course.

In front of the compass is a raised platform on which variously shaped pieces of magnetized iron are placed. They represent the combined effect of the magnetizing influences on board ship. These magnets deflect the compass needle a definite number of degrees from magnetic north, according to their strength and position. The problem is to determine how great the deflection is from the magnetic north, and how to compensate for it.

The scoresby teaches students of navigation how to compensate for the deviation of the compass, due to the presence of iron and steel in ships

Compensation for deflection is made as follows:

The apparent position of the sun is observed and read. This reading is compared with the magnetic bearing of the sun, which is obtained for any position of the ship from a book of tables. The difference between the two bearings is the amount of deviation of the compass. By means of a set of small magnetized rods set in grooves under the compass, which can be moved closer to or farther from the compass, the needle is forced to swing around until the apparent bearing and the magnetic bearing coincide. The deflection is then compensated for, and the compass reads correctly.

It took Captain Knight two months to build this "observation post" without disturbing the young birds; in it he made many "close-ups" of the birds in action

Taking a Close-Up of Young Birds in Their Nest

WITH all the secrecy and caution of wartime work at the front, Captain C. W. R. Knight built an observation post in a tree. He did not, however, wish to observe an enemy in a near-by trench. His object was a peaceful one—to observe young hawks in their nest.

In the dead of night he screwed a bracket to the tree and erected a moving-picture camera on it. He screened the camera with old sacking. Later he fastened a log to two branches and used it for a seat. It took him nearly two months to build his observation post. The sacking completely covered the "post."

Captain Knight cut two small holes in the sacking, one for the camera lens and the other for him to look through.

Often he remained in the tree for hours, observing the unsuspecting birds; whenever they made an interesting move he turned the crank.

Oranges Are Now Used in Making Vinegar

IT has been demonstrated at the Citrus By-Products Laboratory at Los Angeles that oranges produce a fine quality of vinegar.

Experiments were carried out in making the vinegar by two processes—the barrel process, for home use, and the generator process, for commercial purposes. They were equally successful.

An interesting fact in connection with this new industry in those parts of the United States where the orange crop is important is that even frozen fruit can be used for making vinegar.

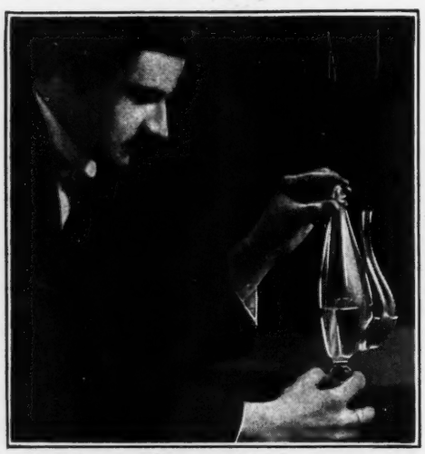
Accurate Predictions from a Dutch Weather-Glass

FOR a few dollars you can buy an old Dutch weather-glass, consisting of a white glass vessel, sealed and airtight except at the end of the spout.

Pour clean rainwater through the spout until it rises just above the top of the spout bulb, and let it stand for a day. The water should be of the same temperature as the air of the room in which it is to remain. The weather-glass must not be exposed to the sun's rays or to the heat of a fire, and it will not tolerate a draft. It must be hung exactly perpendicularly. With these simple precautions the old Dutch weather-glass will prove a faithful weather prophet, for on the approach of bad weather the water rises in the spout, falling again as fine weather becomes imminent.

The instrument is said to be much more sensitive to weather conditions than a barometer. When water is poured through the spout, air of a certain density and pressure is imprisoned in the upper part of the vessel. As we know, atmospheric pressure varies according to the weather, and it is this changing pressure, acting on the top of the water in the spout, that causes the water to rise and fall, the pressure within the glass remaining practically unaltered. In very bad weather the water may even overflow. The spout is graduated for reading.

A sea captain says he has had an old Dutch weather-glass in constant use on board ship for forty years, and never found that their ship's rolling or pitching disturbed the accuracy of the weather-glass in the least.



Said to be more sensitive to varying conditions than an ordinary barometer, this really scientific weather indicator can be purchased for a few dollars. Rain-water is all that is used in the weather-glass

Nothing Stops This Gun

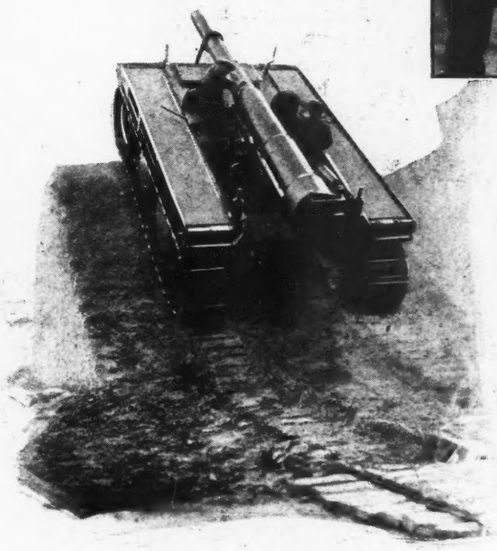
THIS caterpillar gun will ride over any incline that does not exceed 45 degrees. The caterpillar chassis carries a 6.2-inch gun, the muzzle of which is clamped down while the machine is in motion.

This new type of gun was developed through the work of Mr. Walter Christie in cooperation with the United States Ordnance Department. It is a very mobile unit, self-propelled and able to take part in virtually any kind of an engagement. The power plant, which is a large gas-engine, is located directly underneath the muzzle and the controls of the gas-engine are within reach of the operators.

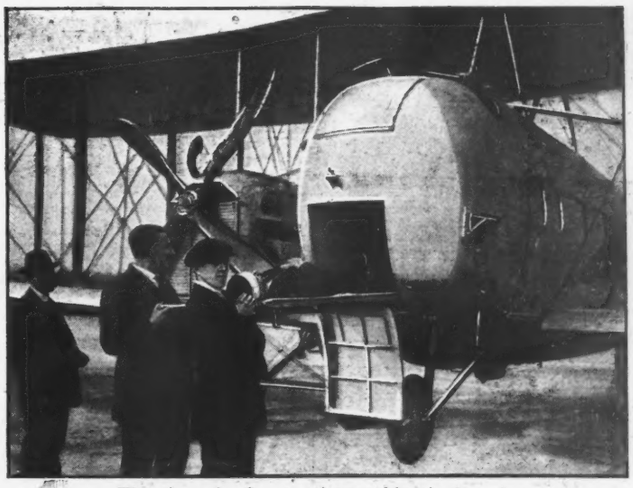
The big gun is here seen crawling over a steep hill somewhere in New Jersey, where it was given its first trial.

One side of the embankment was 45 degrees and the other side was 35 degrees. The gun crawled over it with perfect ease. A traveling track, which is seen over the wheels, is used when the machine is crossing swampy country.

Even in hilly country the new gun can reach a speed of twelve miles an hour. This may be increased to sixteen on a straight road.



The new caterpillar gun of the United States Ordnance Department, crawling over an embankment



Fitted up for four patients, this airplane has room for a pilot, a mechanic, a doctor, and a nurse

Ambulance on Wings

IN England an airplane manufacturer has designed and constructed a hospital of the air. It is a big, powerful machine equipped with two 450-horsepower engines. These are able to drive it through the air at a speed of 110 miles an hour. It carries a pilot, a mechanic, a doctor, one nurse, and four patients. If the patients can remain in a sitting position, the cabin of the machine will accommodate eight of them. Special supports are made for the stretchers, which slide in through a special door at the head of the machine. The stretchers rest in a tunnel that passes through the cabin.

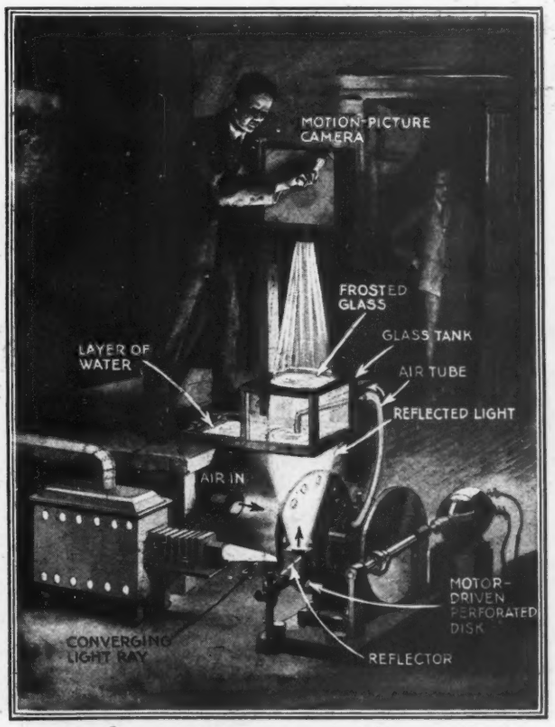
The biplane used has a span of 63 feet and a length of 43 feet. It can carry a two-ton load and can climb 6500 feet in ten minutes with this load.

A Motion-Picture Cure for Faulty Acoustics

AN apparatus by which the action of sound waves and the phenomena of echoes and reverberations in auditoriums can be reproduced in moving-pictures has been invented by Dr. F. R. Watson, professor of physics at the University of Illinois.

By means of this invention the acoustics of a proposed building can be tested out from the architect's plans, making it possible to conquer echoes and other acoustic defects before, rather than after, the building is erected.

A longitudinal section of the building under consideration, made from a narrow strip of metal, is set in a glass tank containing water of less depth than the metal strip. Intermittent puffs of air from an adjustable rubber tube are then directed upon the water in the model from a position corresponding to that of a speaker on a stage. The waves thus set up are exactly comparable to waves of sound; they are reflected from walls and ceiling in exactly the same manner as sound waves. These waves, so faint as to be invisible, are made to throw an enlarged shadow on a plate of frosted glass above, which is distinct enough to be caught by a motion-picture camera that is placed vertically.



By taking moving-pictures of shadows reflected from water, building acoustics can be determined

The streams of both light and air depend on a motor-driven device placed beneath. A stream of air is periodically interrupted by being directed against a row of holes punched in a rotating iron disk.

The air, passing through the holes thus intermittently, is conveyed upward through a tube to the tank.

Against a second row of holes in the same disk is directed light from a lantern.

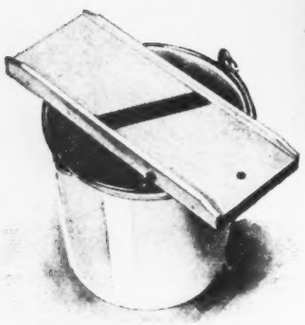
These spasmodic gleams of light are then reflected upward by a small mirror in such a way as to illuminate the model and throw an enlarged shadow of the water waves on the frosted glass plate, and it is the moving-pictures of these shadows that guide the acoustic expert.

Drying Next Winter's Fruits and Vegetables at Home

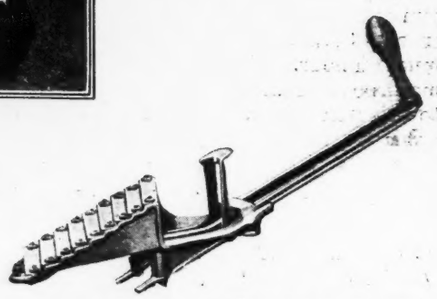
She's cutting sweet potatoes into thin slices, so they will dry easily. The rotary slicer that she uses for the job will cut practically all kinds of vegetables. It can be adjusted to cut uniform slices of any desired thickness; thus all the slices will become dry at the same time

In order to avoid any chance of fire the box may be completely covered with galvanized iron. The trays are filled with sliced fruits and vegetables, which are soon dried out by the heat of the stove. These slices can be stored away for months without rotting

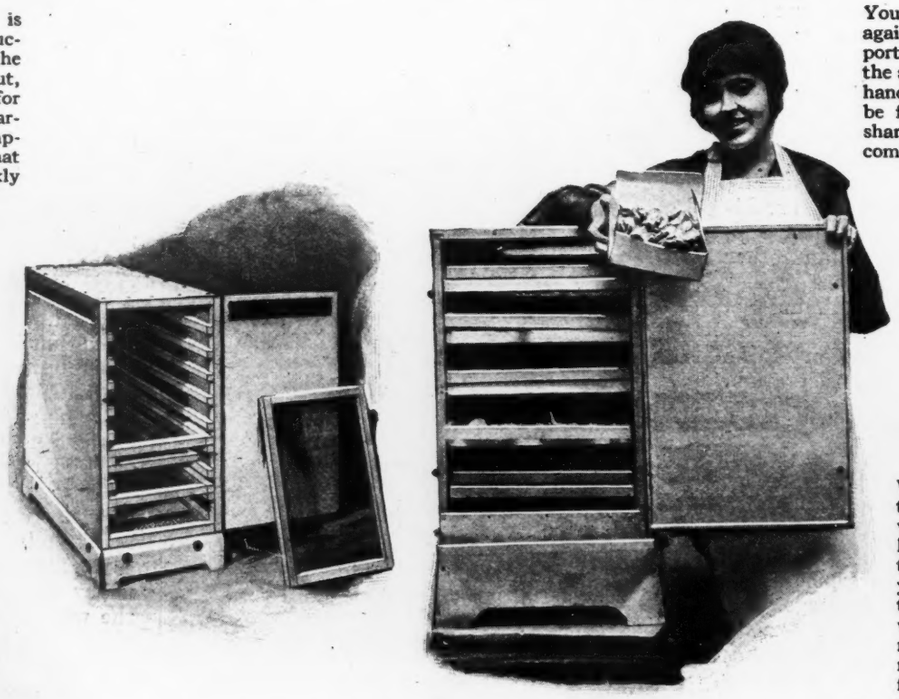
As she turns the handle, the potatoes inside the machine are hurled against a rough surface that tears off the skin. Most vegetables must be skinned before they are sliced and allowed to dry; for one of the chief functions of the skin is to prevent moisture from evaporating



This cutter, which is used chiefly for reducing cabbage to the form of sauerkraut, may also be used for slicing potatoes, carrots, onions, pumpkins or squash so that they will dry quickly



You place an apple against the curved support at the center of the slicer and push the handle. The apple will be forced against the sharp blades and will come out in slices



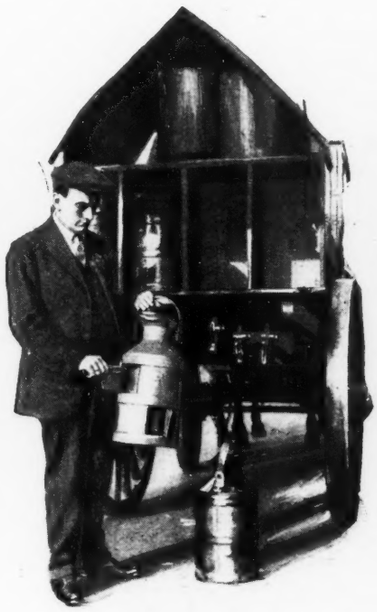
Here is a home-made drier that is very satisfactory. It is a packing-box fitted with trays made of galvanized netting. The top of the box acts as a door. The complete drier is mounted on a galvanized-iron support. It is placed on top of the stove

Whenever you wish to use fruits and vegetables that have been dried in this iron box, all you have to do is to soak them in water. They regain nearly all of their natural smell and flavor in a very short time

When Is a Pound Not a Pound?

Photographs © Kadel & Herbert

Some of the tricks which unscrupulous tradesmen play with weights and scales

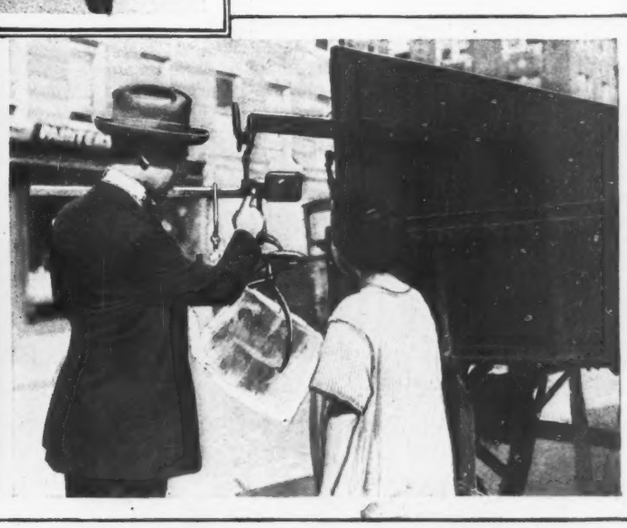


A can within a can gives the oil-dealer a chance to fool the public. The inspector of weights and measures uses his pliers when he is suspicious

Here's an old trick, but it is one that has netted peddlers many a dollar. A weight is tied to the scale arm—it is concealed by the box. Be suspicious when you see scales standing on a box

In this ingenious arrangement, a cord is attached to the scale table and the opposite end of the cord is fixed to a small pedal. Pressure on the pedal makes the scales lie

Here is a simple trick. An iron weight is attached to the bottom of the scale pan, and the unwary customer pays for a half pound of scrap metal that he never receives



The unscrupulous iceman changes the position of the pivot on his ice-scales and in this manner robs his customers of seven pounds of ice every time he weighs a piece for sale

© Keystone View Company

Canceling 120 Letters a Minute

SPEED is the chief attribute of this mail-canceling machine. Its inventor spent fifteen years solving the problem of rapid mail cancellation. This machine is the result. It works like a typewriter. Instead of twenty-seven letters a minute, which is the speed now, the machine cancels as many as one hundred and twenty letters a minute.

Mail is placed in a long feeder, in front of which sits the operator. A keyboard with fifteen keys is manipulated to direct the envelopes into fifty-six different mail-chutes, after the stamps on the letters are canceled. A special machine is now being designed for use on mail-cars.

Mr. Max Voighlander, the inventor, has interested the United States Postal Department in his device.

Feet Are Needed to Propel This Boat

PADDLE-WHEELS make the boat in the picture below resemble in miniature the old side-wheel steamers that formerly carried passengers and freight.

As paddle-wheels are going out of style on the large boats, they seem to be coming in on small ones. What is more, the young man in the boat pedals the paddles. As he turns the pedals with his feet, the paddle-wheels on the sides of the skiff churn the water and easily drive the boat forward.

The steering is done by means of a lever that operates a rudder. There is, however, a pair of oars on board that can be used should the foot mechanism get out of commission.

He Built a Wind-Shield for His Cigar-Lighter

THE ordinary cigar-lighter is almost as easily blown out by a sudden gust of wind as a match. One tobacconist, whose stand was located outdoors on the municipal pleasure pier at Ocean Park, California, where the wind always blows, decided to remedy his customers' discomfort when they tried to "light up" at his stand.

After giving the matter considerable thought, he provided his cigar-lighter with the wind-shield shown in the picture. Now the customers' troubles are ended, and they can light a cigar or pipe at the first attempt.

Danger of Being a Prodigy

RECORD of a remarkable mathematical prodigy appeared in the London *Lancet* some time ago. In this case the man's extraordinary ability in arithmetical calculation was accompanied by an otherwise marked inferior general mentality.

The prodigy was blind, yet he was able to calculate the square root of any number running into four figures in an average of four seconds, and the cube root of any number running into six figures in six seconds.

This Machine Sews in Circles

WHEN the great lengths of cloth come from the looms in the mills, they must be sewn together before they are passed over the singeing machine and placed in the bleaching-vat.

The machine that is shown in the illustration above, which sews in circles, is placed in the finishing department of the big textile mills.

The needle travels around the circle and sews the ends of the long sheet together as it goes, thus producing a single long piece, such as are seen in the stores. This is then passed over a hot plate, which singes off the nap.

The cloth is then ready for the big bleaching-vats.

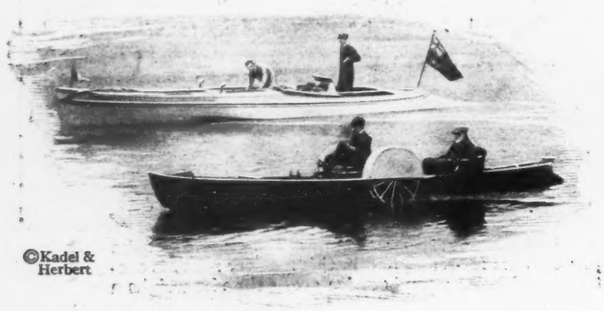
Many miles of cloth are handled every day in these mills.

Good Roads Mean Prosperity for a Community

BELOW is shown a one-man road maintainer that is more economical than a horse scraper because of its greater speed and because, with its six-cylinder motor developing eight horsepower on the blade, it replaces two or three teams of horses and two or three men. Any one able to drive a car can operate this machine.

The blade attachment is swung at an angle underneath the machine. The blade itself is adjustable both to the curvature of the road and the depth of the cut.

The outside right-hand blade is the smallest blade and it is placed in a more angular position. In operation it keeps the dirt always rolling toward the center.



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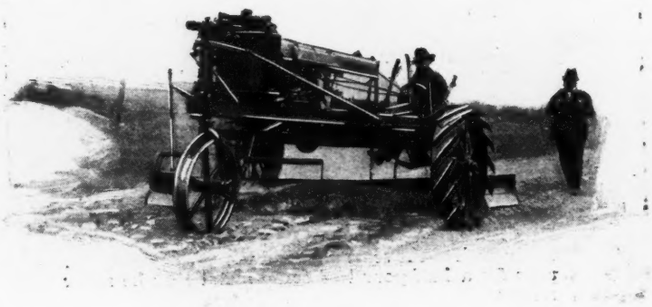

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When the Elephant Gets a Cold

ELEPHANTS catch cold just as other animals do, and when this is the case the keepers at the zoo have a hard time curing them. Above is pictured one of the methods used.

A bucket containing boiling hot vinegar is placed in a canvas bag. The bag is then placed over the big fellow's trunk, so that he will inhale the vinegar vapor.

An elephant seldom objects to this treatment, since he seems to understand that it helps him to breathe. The picture shows him taking his medicine like a man.

Build a House for Twenty Cents

TWENTY cents will buy you an ice-cream soda, and it will buy you a house —that is, if you can follow the methods used by Mr. Lewis Dart, of Redondo Beach, California.

Mr. Dart arrived in California a sick man without funds. He gathered the wood that drifted on to the beach. He drew out the nails, straightened them, and began to build his house against the rocks. As the wood drifted in, the house grew in size, until it was ready for a roof.

It was then that Mr. Dart discovered that he did not have enough nails to finish the job. He bought twenty cents' worth.

Now he is a strong, healthy man, and he earns his living by serving lunch on his veranda.

Hold the Transmitter to Your Throat in Telephoning

WHEN a telephone is located in a noisy place, much of the noise is transmitted when anybody talks over the telephone. This makes receiving difficult at the opposite end of the line.

To eliminate this trouble a "throat transmitter" has been developed. The transmitter is placed against the throat, and the voice is transmitted just as clearly in this way as in speaking into the transmitter and the noise is eliminated.

Such transmitters were much used during the war. Even an ordinary telephone will transmit sounds when held to the throat.

Detecting Bubbles in Castings

IN the manufacture of a small automobile accessory Harold G. Fitzgerald, of Los Angeles, California, uses a small casting of aluminum alloy. Such castings sometimes contain bubbles, and a bubble means a hollow place and therefore a weak spot.

Considerable trouble was experienced with these castings. Breakage was usually due to a bubble. Mr. Fitzgerald conceived the idea of testing the castings by weight. A solid casting would weigh a certain amount, and obviously one with a bubble in it would be lighter. An apothecary's small balance was used for testing.

Fresh Air by Megaphone

FRESH air may find its way into a closed room through a megaphone. This megaphone is connected with a long pipe that leads to the roof of the house. The pipe has a covering over it to keep out the rain and snow.

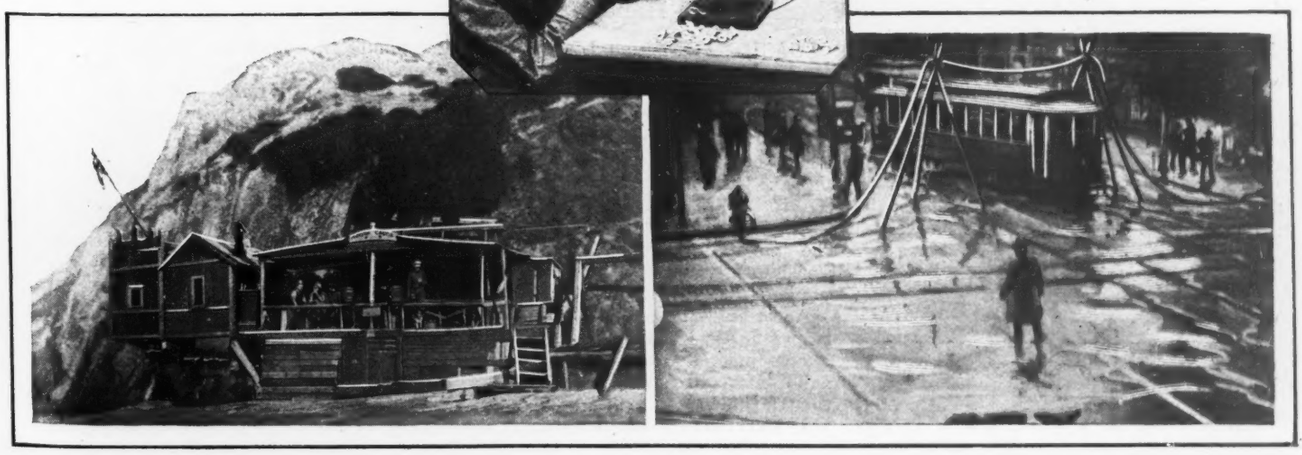
A cool stream of air flows down into the face of the sleeper. In some cases it is better than having a window open. Any old phonographic megaphone may be pressed into service, and it makes a very good use for an old article that is not of much value otherwise.

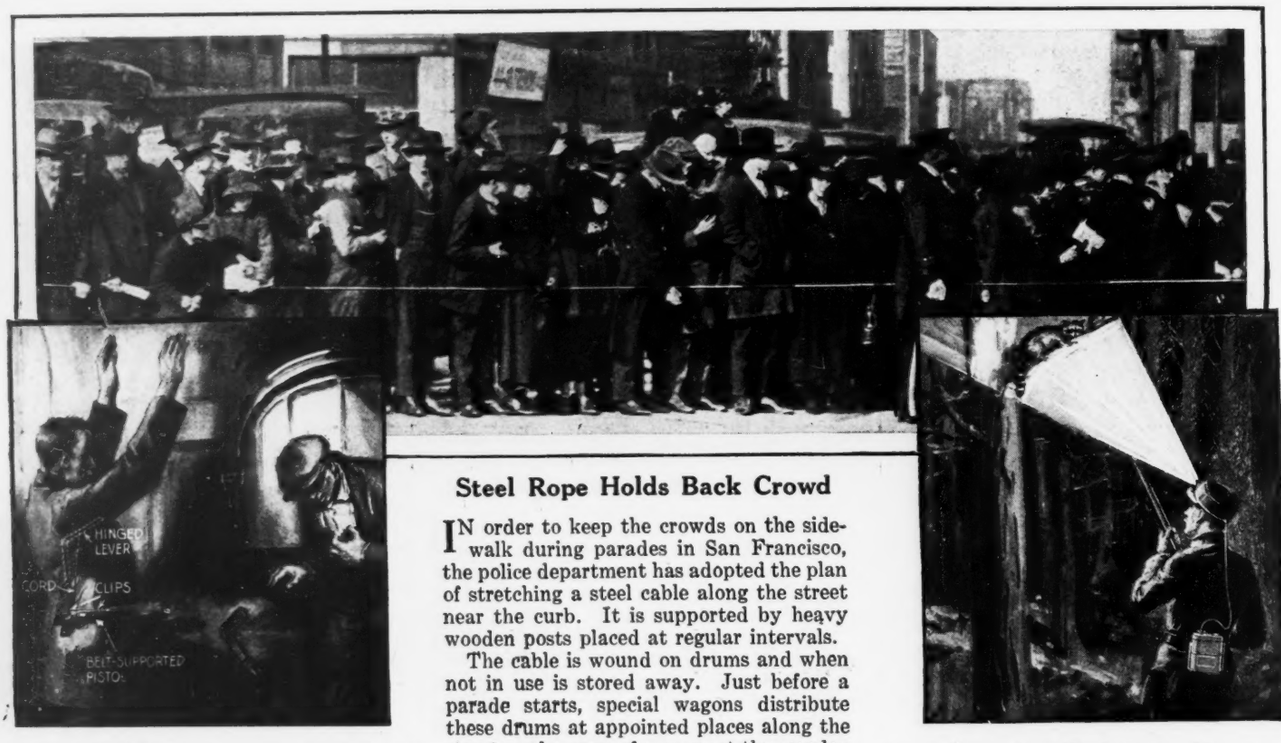
Tripods Support Fire-Hose

OF course, street-cars and traffic generally must be stopped in the immediate vicinity of a fire. But often there are hose leads carried for blocks, across streets, and effectively tying up traffic not otherwise affected by a fire.

Years ago, in Washington, firemen used a couple of tripodlike affairs that they placed on each side of the street-car tracks. These tripods served as supports or abutments for the hose that was carried over them as a sort of suspension bridge, under which cars and other traffic could pass.

This apparatus might well be adopted by other city fire-departments. Its use would avoid the blocking of traffic at fires of any magnitude which often disrupts an entire street-car system for hours.





When a Burglar Says "Hands Up"

MEETING the owner of the cash or diamonds he is looking for, the highwayman directs his victim to raise his hands. How can that unfortunate obey and at the same time reach for his gun?

This is the problem to which Samuel Vlanch, of Sioux City, Iowa, applied himself, with the result that he has invented a belt to which to attach the revolver, carrying a mechanism connected with a hinged strap that passes over one shoulder. When the arm is suddenly elevated, this mechanism operates in such a manner as to pull the trigger of the revolver.

Query: Would it be safe for a lady to say "good evening" to the wearer of this belt?

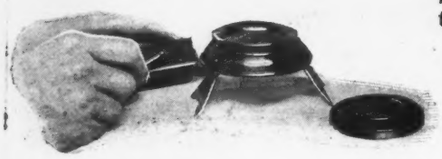
Keep a Stove in Your Pocket

AN alcohol stove that you can keep in your vest-pocket! It is not a mere freak, but a practical little device that will produce considerable heat for the warming of beverages or the heating of curling-irons.

The alcohol burns through a small piece of fine copper gauze—no wick is used. A small cover fits over the top and prevents the fuel from running out into the pocket.

The device is no larger than a watch, and it may be carried about in a man's pocket or a woman's handbag with the same convenience.

A small charge of alcohol will bring a fair-sized pot of water to the boiling-point in a short time. Several charges of fuel will cook a meal.



Steel Rope Holds Back Crowd

IN order to keep the crowds on the sidewalk during parades in San Francisco, the police department has adopted the plan of stretching a steel cable along the street near the curb. It is supported by heavy wooden posts placed at regular intervals.

The cable is wound on drums and when not in use is stored away. Just before a parade starts, special wagons distribute these drums at appointed places along the street, and a crew of men erect the wooden posts and attach the steel cables to them. Later these same wagons follow up the parade, and the posts and steel cable are loaded into them.

He Has Six Fingers on Each of His Hands

OCCASIONALLY you hear of a man who has too many fingers or toes. Did you ever see one? If not, you will be interested in the picture of the man shown above. He has six perfectly formed fingers on each hand, and they all are active members. When the photographer wished to take his picture, he obligingly rested all twelve fingers on his chest.

The only time his extra fingers bother him is when he wishes to play the piano—they get in the way.

According to biologists, if this twelve-fingered man should marry a twelve-fingered woman, most of their children would have twelve fingers, though the tendency might not appear until the next generation.

Acetylene Headlights for Hunters

WILD animals nowadays have an unhappy time attempting to escape the hunter. The modern hunter wears an acetylene lamp fastened to his cap and supplied by a generator carried on a belt around his waist. Such a lamp leaves the hunter's hands free and throws the light where he is looking.

The light is so penetrating in its brilliance that it shows objects through the thickest fog or mist. It cannot blow out and has a self-lighting attachment that makes matches unnecessary.

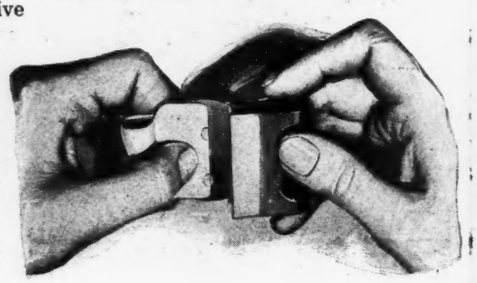
It is claimed that this lamp will burn ten hours on one charge of carbide and water, and costs less than one cent an hour.

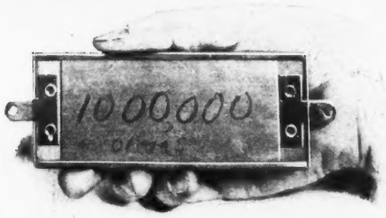
This Strop Also Fits the Pocket

TRAVELING men will surely welcome a razor-strop for safety-razor blades that is small enough to be carried in the pocket. This makes extra blades unnecessary.

Provided the strop is in his pocket, a man going away from home for several days need take merely the blade in his razor.

Two specially prepared rubber pads are mounted in a little holder so that they may be pinched together. The dull razor-blade is also provided with a small holder so that there will be no danger of a cut finger when sharpening a blade.





Units of Electrical Resistance

THE ohm is the unit of electrical resistance. Electricity meets resistance in flowing through a wire just as water meets resistance in flowing through an iron pipe.

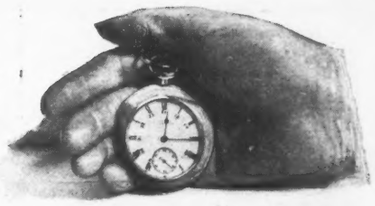
Often an electrical worker must crowd a great amount of electrical resistance into a small space. We might say that this resistance is used to hold the electric current back and to prevent too much from flowing through the circuit.

The little device shown above has an electrical resistance equal to many miles of large copper wire. One million ohms are crowded into a very small space. When an electrical current meets such an obstacle as this, it must struggle to get through, and much of it is prevented from doing so. Such resistance units find wide use in electrical experimental laboratories.

Sermons by Wireless

WHEN the pastor of a church in Pittsburg was suddenly taken ill on a Sunday afternoon, when it was impossible to obtain a substitute, a novel plan was resorted to. The Calvary Episcopal church, located ten miles away in the same city, had been sending out its service by radio for several months. The pastorless church installed a compact receiving-set and a loud-speaking horn, and the music and the sermon in the Calvary Church were distinctly heard.

There is one advantage in the preacher's being ten miles away: he could not see that bald-headed man in the third row who always sleeps comfortably throughout the discourse.



Rubber Coats for Watches

PROTECT your watch from scratches, dirt, falls, and general hard wear by enclosing it in a rubber case during working hours.

This idea comes from Mr. J. E. McKenzie, a resident of Medicine Hat, in Canada.

The picture above shows one of these cases in use.

The back of the cover is made entirely of rubber and the front half is cut out to expose the face of the watch, an idea evidently taken from models of old hunting watch-cases, which sometimes had practically the whole face covered and the figures of the hours engraved on the case.

There is a hole at the top for the stem. Thus the rubber case can be put on and taken off rapidly at the beginning and end of a working day.

His Store Floats and Customers Arrive by Boat

"LET'S row over to the store," says the man who wants to buy some marine supplies.

The owner of the store pictured below figured that marine supplies could logically be sold from a boat, and he was not mistaken. He started with a single store. Business was so good that now he has decided to build a chain (or a fleet?) of store-boats.

He will place the boat-stores near busy waterways and harbors, where motor-boat owners, rowboat owners, canoe owners, even yacht owners, are sure to be found, with all their varying needs of special marine equipment. The windows give some idea of the varied stock required.

It Bundles Grain into Shocks

FOR rapidly bundling grain into shocks so that it will not be exposed to rain, Harry Baxter, of Newman, Illinois, has invented a revolving device attached to a harvester.

An operator takes the sheaves as they are deposited from the binder, arranging them compactly in a hollow frustrum.

When it is desired to top the sheaf with a cap, the first sheaf inserted in the frustrum is spread at its base and the other sheaves are inserted against the spread one. When the hollow frustrum is full, the support is swung out of the path of the shock by manipulating a handle; thereupon the loaded frustrum will drop, the shock turning to a vertical position.

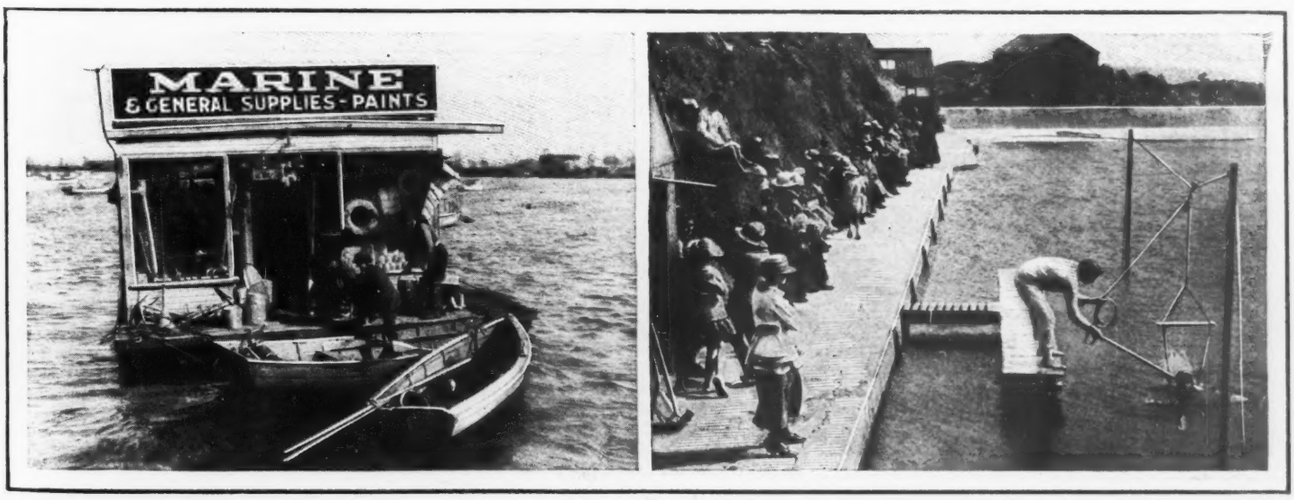
How They Learn to Swim in Scotland

NEARLY every swimming instructor has a method all his own. In the picture below you see a Scotchman teaching a girl how to swim in a small pool located within the entrance to the Firth of Forth.

The instructor stands on a platform, with a rope in one hand and a pole in the other. His victim is held in the water by means of a swing that is suspended from a pulley and controlled by the rope.

What is the pole for? To correct the swimmer's arm and foot movements, and the pulley permits of a quick adjustment of the swimmer's body in the water.

Imagination is left free to picture what would happen should the instruct or lose hold of the rope.

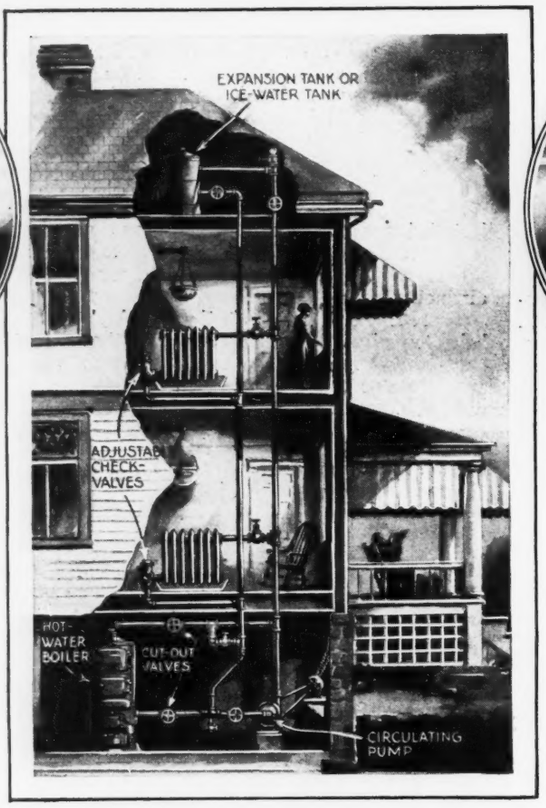


This Little Implement Makes Knife-Sharpening Easy

KNIFE-SHARPENING with a steel or a grinding-wheel usually requires a certain amount of skill. You must know the proper angle at which to hold the blade and the pressure necessary in order to give a smooth finish.

There is now a knife-sharpener that attends to these details for you. It consists of two rough-edged wheels mounted on a wooden handle so that they touch each other.

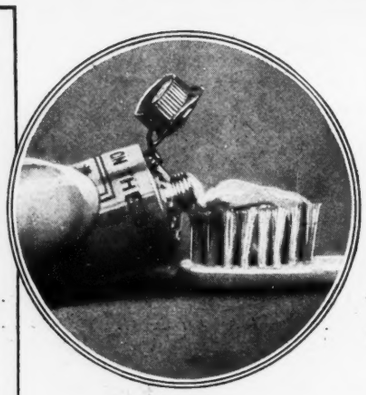
To sharpen a dull knife you draw it between the two wheels and it is sharpened on both sides simultaneously. The wheels can be revolved into a new position when they become dulled from too much wear.



Turn the Heating Plant into a Cooling System

MANY men, moved by the unsightliness and utter uselessness of radiators in summer, have wondered why they could not be used to cool a hot room in July or August. The same pipes that conveyed hot water or steam throughout the house in the winter will also carry cold water in the summer and keep the air of the house from eight to ten degrees cooler than the outdoor thermometer registers.

This result can be accomplished with very little expense once the hot-water system has been installed. Of course you will need a water-cooler for the summer. It may be installed in either the cellar or the attic, unless there is a well in your grounds from which you can get naturally cooled water. Pans must be placed under radiators to catch the moisture. Also there must be outlets at the top of the radiators, as cold naturally has a reverse action to heat.



No Excuse for Letting the Tooth-Paste Dry

HOW often do you put the screw-cap back on your tube of tooth-paste when you finish using it in the morning? Most people have a habit of leaving it off. The paste at the mouth of the tube dries during the day, and the next morning it is hard and useless.

For the busy, nervous man who simply cannot remember to replace the screw-cap, the little hinged cap shown in the picture above is recommended. It opens like the cellar door. Most important, it is never lost, since it is always fastened to the tube. Thus there is no possibility of the tooth-paste getting dry and useless, and in consequence being wasted.

Salt Water Kills Grass

SALT helps to preserve cut vegetables, and yet when it is sprinkled on the ground it will kill any vegetation. If you wish to make a path across your lawn, for instance, sprinkle salt on the grass instead of digging it up. The salted grass dies.

In the picture below you see two men literally salting down a path. One of them pumps the salty water while the other one holds a hose over the doomed grass.

It is possible that students of agriculture have taken note of the effect of salt and alkali on the vegetation of Colorado and Arizona, and other Western states, and that they learned they could apply nature's methods to their own ends.

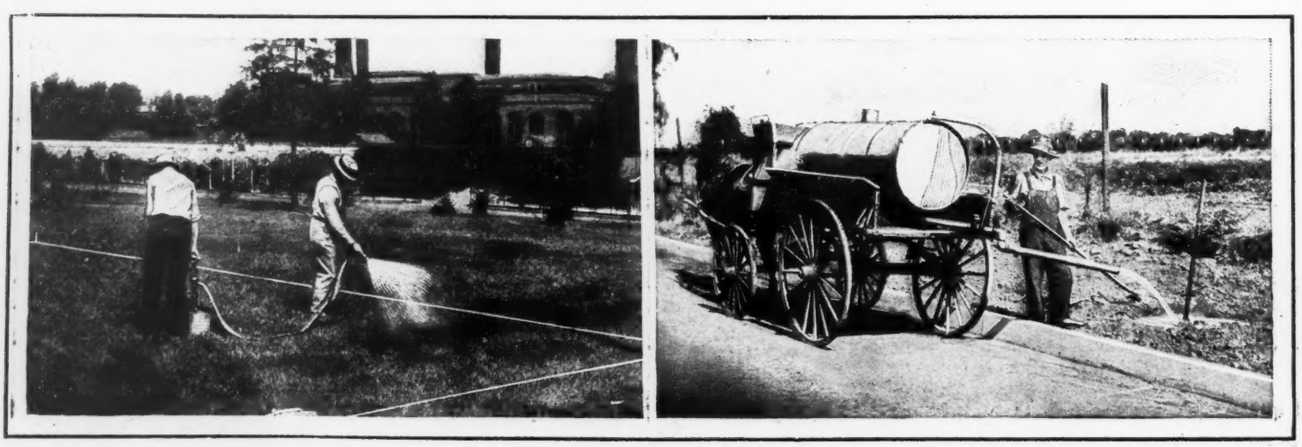
Common salt and green vitriol (iron sulphate) or blue vitriol (copper sulphate) are commonly used to eradicate grass.

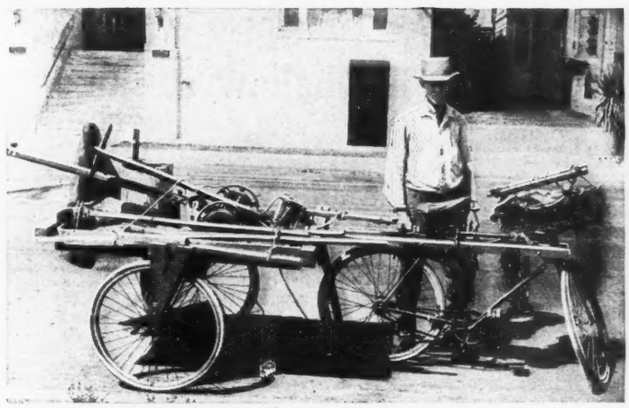
The Spout Swings to the Tree

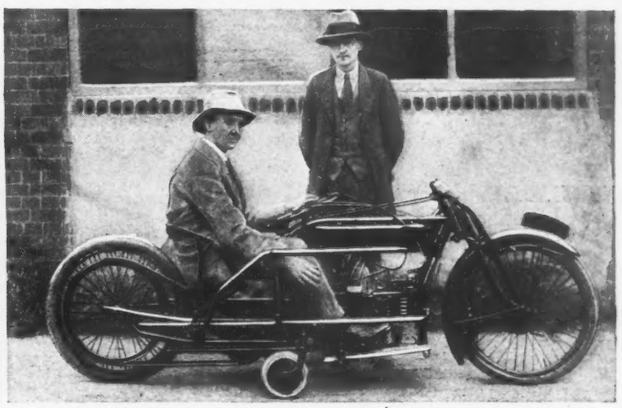
A FEW years hence the city of Glendale, California, plans to have one of the most beautiful oak-tree drives in the country. All trees along a five-mile motor thoroughfare have been removed and tiny live-oaks have been planted at regular intervals along the road.

Until these little oak-trees are well rooted, they must be carefully tended. The watering of them presented a problem, because there are no water-mains for three miles along the oak-tree avenue.

The city engineer rigged up a tank-wagon. This wagon has a spout that may be swung into the parkway along the road to water each tree. The driver merely swings out the spout and turns on the water. He proceeds from tree to tree until the whole lane is watered.







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The Traveling Lawn-Mower and His Outfit

LOS ANGELES boasts a man who believes in doing a job thoroughly, even the apparently simple job of looking after lawns and shrubbery.

This man makes a business of cutting grass and taking care of lawns. He is a great help to the busy suburban dweller who likes to see the grass cropped closely but does not have the time to do it himself. Along comes this man with his "shop," and within a few hours' time he has trimmed the grass and shrubbery to the queen's taste.

He uses a bicycle with a small rubber-tired trailer to carry his tools. The bicycle is clamped between two rails that are attached to the front of the trailer.

Is This an Automobile or a Motorcycle?

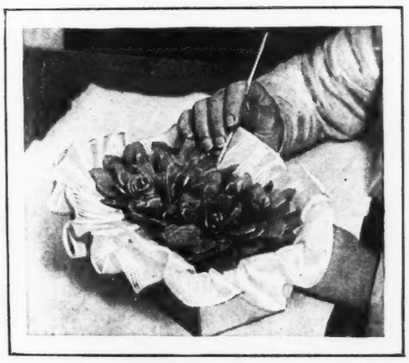
PICTURED above is a peculiar combination of motorcycle and cycle-car. It drives like an automobile and rides like a motorcycle. In place of the usual handle-bars, the machine has a wheel similar to those used on automobiles.

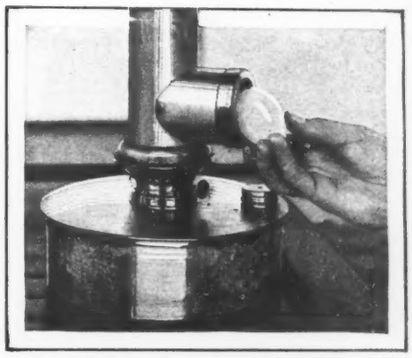
When the vehicle is standing still, two small rubber-tired wheels are placed in contact with the ground to prevent the machine from overturning. These wheels are manipulated with handles. The wheels are also used when the machine is traveling at low speed in heavy traffic. The trailer wheels are fitted to the chassis in such a way that they will follow the uneven surface of the road. A low center of gravity prevents slipping and skidding.

Photographing the Last Lap

WHEN the finish of a race is close, it is often difficult to determine which horse first crossed the line. The judges have an unobstructed view of the track and are in a better position to judge the result than persons on the ground level. But in the excitement of a close finish the observers are sometimes misled, and disputes arise concerning the judges' decision.

The camera shown below makes such disputes impossible. At the moment of the finish the shutter is released and an indisputable record is obtained.





With a Hatpin She Makes Rye-Bread Flowers

FROM loaves of rye bread flowers grow—that is, if the bread is in the hands of Mrs. Johannemann, of Willowemoc, New York. She takes a fresh loaf of rye bread in one hand and a hatpin in the other. In a short time the top of the loaf is transformed; roses, violets, tulips, and leaves are the result of her skilful manipulation of the pin.

It is not unusual to see flowers made of vegetables, but that does not appear such a difficult art as making them of bread, which has such a tendency to crumble.

The picture above shows a box of rye-bread flowers that Mrs. Johannemann made and sent to Mrs. Harding at the White House. The bread dries soon and as a result the flowers become firm.

Make Your Own Candler for Testing Eggs

A POULTRY husbandman of the United States Department of Agriculture has devised a simple egg-tester that can be made at home.

A tin chimney with an extension on its side is used in connection with an oil-lamp. The extension is provided with an opening and the egg is placed in front of this.

A dark room facilitates the identification of a bad egg. The big end of the egg is held up, a position that readily reveals the size of the air cell as well as the condition of the embryo. An infertile specimen, incapable of germination, looks clear when candled, while a fertile egg betrays a dark spot described as the embryo. When the embryo is diseased and the egg has been incubated for at least forty-eight hours, the blood settles away from the embryo toward the outside.

More Water for the Propeller

An ingenious device that lifts the water in shallow streams

By P. J. Risdon

English correspondent for the Popular Science Monthly

WHEREVER shallow water is encountered in canals and little rivers, there is danger of boat propellers fouling the bottom. To prevent this the propellers are sometimes housed in vertical recesses in the hull, known as "tunnels," the tops of which slope downward fore and aft. For vessels that are of considerable draft, even when light, this arrangement serves the purpose; but when the draft is very small, the tunnels are of little use, as the propellers must necessarily be submerged a certain depth, which may be greater than the draft of the boats.

How Additional Water Is Raised

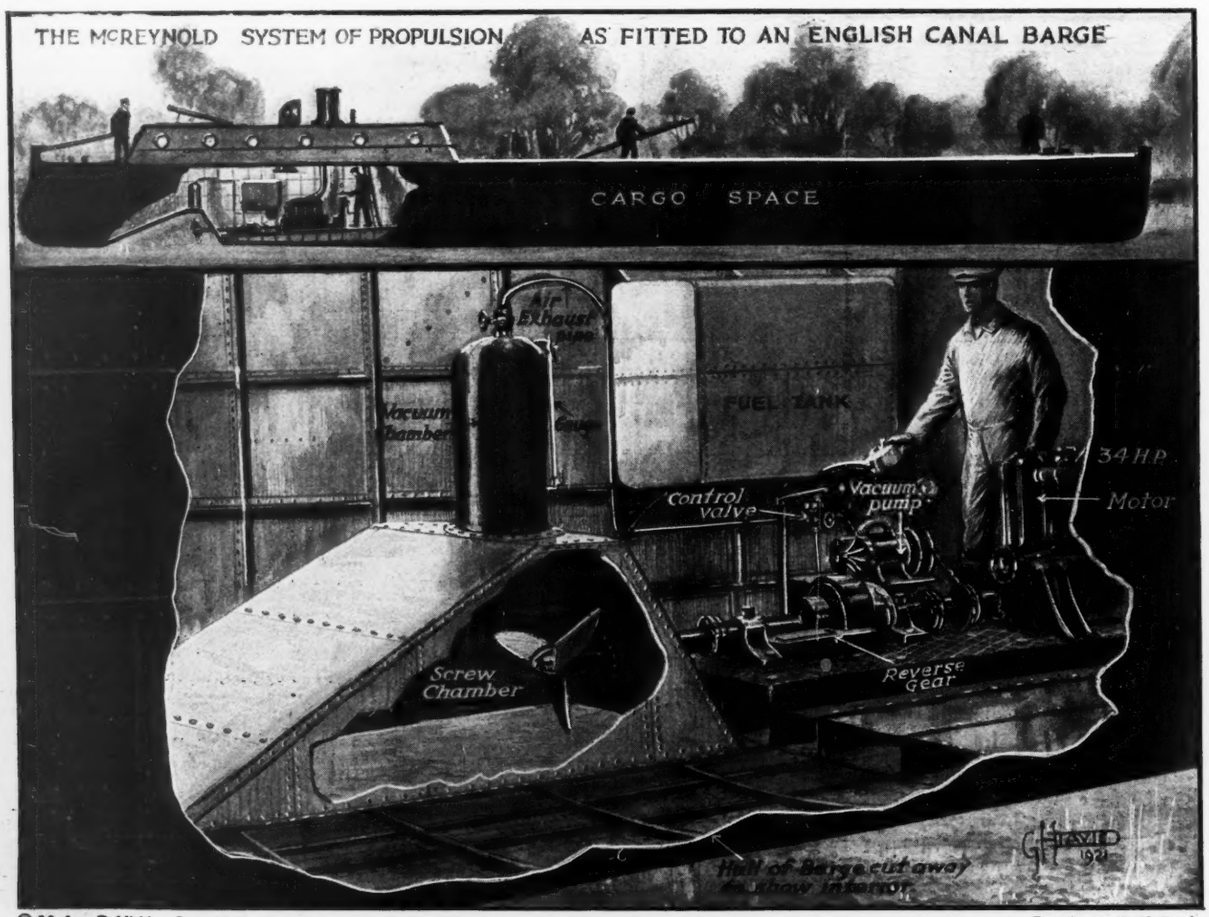
An Englishman named McReynold has invented an ingenious device by means of which, instead of being obliged to lower the propeller of a shallow-draft boat below the level of the keel, water is actually raised by suction in the propeller tunnel to a higher level than the surrounding water, and maintained at that level as long as the propeller is at work. It sounds rather like holding on to something and trying to push it away at the same time, and in point of fact the analogy is not really a bad one because it appears that efficiency is to some extent impaired.

The device is simplicity itself. At the top of the tunnel is a tube, or pipe, connected to an air-exhaust pump. When the pump is started, it exhausts the air from the tunnel, and the resulting suction draws the water in the tunnel up to the required level, completely submerging the propeller, the lowest point of which is thus kept well above the lowest point of any shallow-draft, flat-bottomed boat, and consequently protecting the propeller from damage. Outside the tunnel is fitted a glass tube in which the water rises to the same level as in the tunnel, and which thus serves as a water-level indicator or gage.

The propellers, of which there may be either one or two, are inclined slightly downward at an angle of about ten degrees with the horizontal.

Some of the Results

It is further claimed for the system that it eliminates "wash" from the propeller, and renders it highly satisfactory on canals and narrow waterways. In a recent trial on an English canal, a boat, fitted with a thirty-four-horsepower, four-cylinder motor, and loaded with twenty-five tons, was propelled at a speed of four miles an hour, and afterward, acting as a tug, towed another barge laden with thirty tons at a speed of three miles an hour. This does not denote a high degree of efficiency, but efficiency has sometimes to be sacrificed in order to meet unusual circumstances.



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Drawing by G. H. Davis

In this invention of Mr. McReynold's, water is raised by suction in the propeller tunnel to a level higher than that of the surrounding water, giving the propeller sufficient water, in shallow streams, to work in

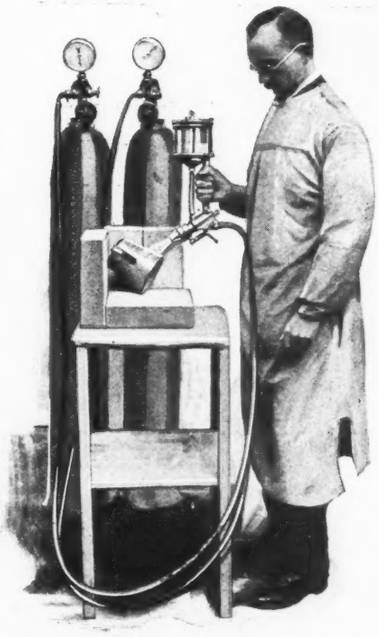
Enameling with a Torch

IN the ordinary process of enameling, sheet iron is first freed from grease in an oven, cleansed and dried, then covered with a layer of enamel. This first layer is then melted in an oven, and an enamel of different composition applied, melted, and cooled slowly. Now a new process has been evolved that is incomparably simpler.

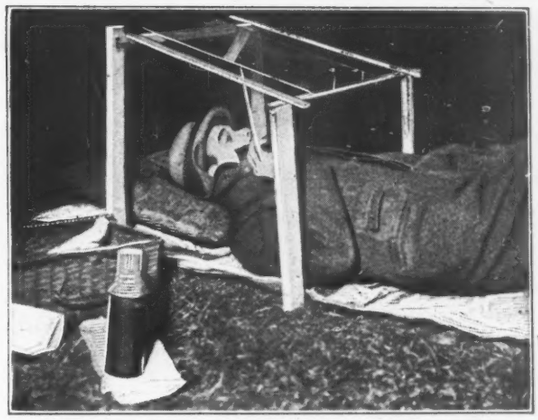
An enamel powder is drawn in small quantities from a reservoir. It is drawn off in a current of driving gas of compressed air or oxygen. This driving gas current mixed with enamel powder is introduced into the nozzle of a burner, the nozzle system of which is fed with an explosive mixture of combustible gas with oxygen or compressed air. The enamel powder, blown forward at a high speed by the jet of driving gas, is melted in the hot flame produced by the ignition of the explosive gas mixture, and is projected on the work to be enameled with great force.

The latter should be heated to a temperature sufficing for the welding of the liquid enamel, which is either effected by special agents or by another flame coming from the nozzle system. A uniform adhering coating of enamel, the thickness of which depends on the duration of the sprinkling process, is produced by this means. By slowly moving forward the enamel sprinkler, the whole surface is evenly coated.

This process is cheaper than the old way; also the enamel is more durable and permits of defective parts being readily repaired.



In a new process for enameling, a powder is drawn from a small reservoir in a driving gas of compressed air or oxygen



He is making a map of the stars by the simple method of marking them on a glass plate

You Can Make Your Own Map of the Stars

ANY amateur astronomer can easily make an accurate map of the constellations. He has but to lie on his back and mark, or "spot" on a sheet of transparent material, such as glass, the stars overhead just as he sees them. The brighter stars can thus quickly and readily be located on the glass, after which photographic prints can be made by using the glass as a negative.

In this manner it is possible to plot all the bright stars passing across the zenith and a large surrounding area of the sky. Reference to a star atlas, or star chart, will disclose the name of each star.

The best way to become familiar with the stars is to observe them on a few clear evenings during each of the four seasons. Thus the conspicuous stars of spring, summer, autumn, and winter can be learned. When you have thus made their acquaintance, they are easily remembered.

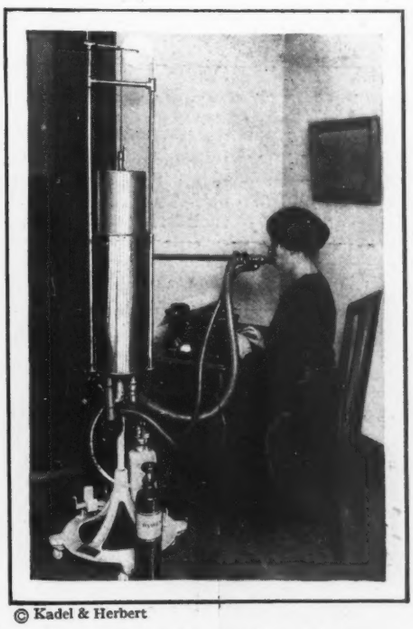
Health Determined by the Amount of Oxygen Consumed

THE amount of oxygen consumed in performing a particular piece of work is believed to be a definite indication of a person's health and general physical condition. To diagnose your health it is therefore as important to measure your oxygen supply as to take your pulse or temperature.

An ingenious instrument has been devised that will measure the intake of oxygen as you write a letter, saw a board, walk about the room, or perform other familiar forms of exercise. It is in use in the laboratories of several colleges and in the near future will probably be part of the equipment of doctors' offices.

In order to measure all the air inhaled, the instrument is fitted with a mouthpiece like those used on gas-masks during the war. A piece of rubber fits under the lips in such a way that no air can be inhaled or exhaled except as it passes through it. The nose is closed meanwhile by strong nippers. From the mouthpiece runs a long, flexible hose connected with the oxygen tank.

The length of the hose makes it possible for the patient to move freely about the room and perform a variety of exercise. An observer meanwhile obtains accurate readings of the quantity of oxygen consumed.



© Kadel & Herbert

In measuring the amount of oxygen used, the subject's nose is clamped and a mouthpiece is placed over the mouth

When a case is to be diagnosed, the patient is first examined while lying upon a couch, so that the consumption of oxygen during relaxation may be compared with that going on while the patient is performing various tasks.

Readings are then taken while the patient operates a typewriter or moves about the room or performs some more violent exercise. When these readings are taken in connection with the blood pressure, temperature, pulse, and other symptoms, an accurate diagnosis becomes possible. The results of a series of experiments made in various laboratories have proved of great value.

By examining a variety of subjects under various conditions it has been possible to establish the normal amounts of oxygen required for various forms of work. When a patient's oxygen consumption is measured, his variation above or below the normal can be given at a glance.

In the City of the Lilliputians

Seventy small people have their own fire department and police force in their own little town

Yes, there is a fire department, and it greatly interests visitors. We doubt, however, that it would be of much use in a big fire

These men and women—some of them no larger than dolls—are perfectly normal in all other respects. They live in a small town where all things are small, not very far from Berlin

This is the candy-store, and it is well patronized by the children of the neighborhood. The counter, which is the right height for children, is almost too high for the Lilliputians

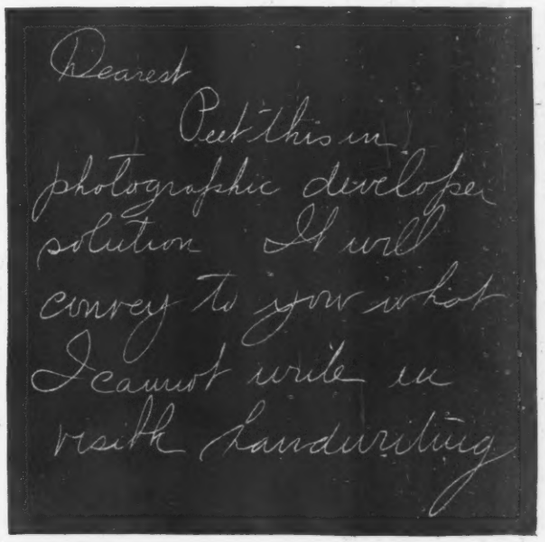
Photographs © Keystone View Company

Here you see the oldest inhabitants of the town; both of them are sixty-eight years old. They own a small toy-shop and earn their living selling toys to curious visitors

The post-office is the center of interest, as is the case in all small towns. Most of the relatives of these people are full grown

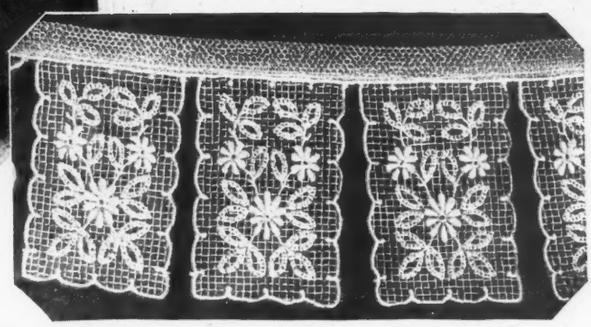
A man in a bartender's coat is brought up before a police captain. If he lived in the United States we should know why he was brought there

Solving a Few of the Knotty Problems that Face the Photographer



This touching message was written in pencil on sensitized photographic paper in the dark-room. It was exposed to the light for a second and then washed in a tray of ordinary water to remove the pencil marks. The writing was invisible and did not show up until the paper was put in a developer solution

An old clothes-wringer will greatly reduce the time usually consumed in ferrotyping. The photographs are placed on black ferrotype tins and rolled through the wringer



A plate is not necessary in taking photographs of lace. Instead, the lace is placed on sensitized printing paper, exposed for a second to daylight, and then put in the developing solution

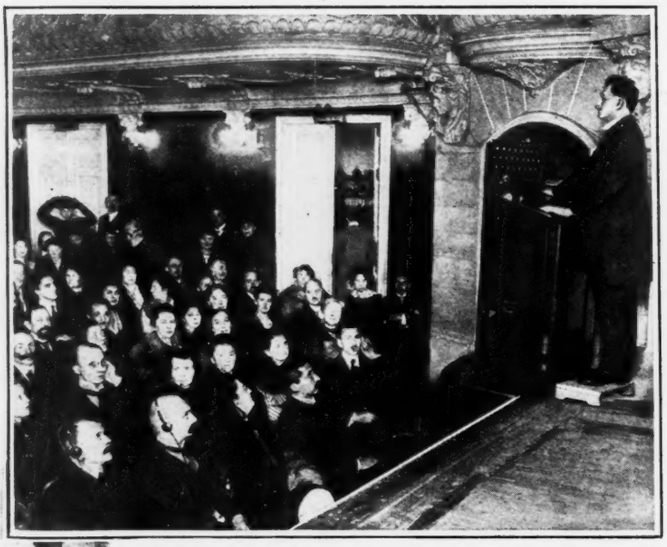
(*Left*) The problem of keeping the dark-room dark in order not to disturb negatives in the developer has troubled many photographers. Opening and closing the dark-room door is the chief cause of trouble. Here's the remedy: Make a revolving door out of four regular doors

(*Right*) He's taking pictures of the ceiling. On his chest stands one of the new aluminum lamps, weighing less than two pounds. Lying on the floor in this fashion, he is able to manipulate both lamp and camera with ease

The Truck that Hugs the Barrel

THIS paper- and barrel-handling truck has a bear hug. Its steel arms hug so tightly that they are able to lift a heavy roll of paper clear off the ground and carry it away.

The grip of the arms is tightened about the paper by an electric motor that is supplied with current by the storage-batteries carried by the truck. This same motor drives the truck seven miles an hour. The arms will grip a roll having a diameter of three feet.



Lecturing to an Audience of Deaf People

LECTURING to deaf people. That sounds peculiar, but it has been made possible, and it is now an every-day occurrence in Germany, where the system was developed.

Each member of the audience is provided with a small ear telephone connected with an electric circuit that also contains a powerful voice-amplifying device that is placed before the speaker. The members of the audience receive the amplified voice currents through the small ear telephone, and all other disturbances are eliminated.

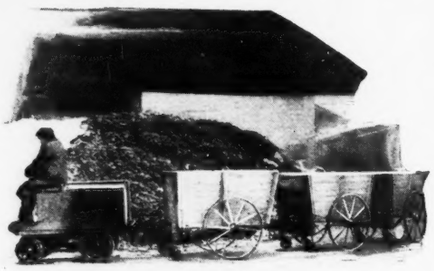
This system has been introduced in America, and a very successful lecture was carried some time ago in New York city. There is nothing complicated about it and nothing to get out of order.

Easier Work for the Glue-Makers

IN the stockyards are great piles of refuse ready to be hauled to the glue works. Formerly two workmen, one who pulled and the other who pushed, constituted the propelling machinery of the hand-cart into which the refuse was shoveled.

With the aid of a small tractor, one workman now pulls three or more of the cars loaded with the scraps of animal substance from which the glue is to be made. All he has to do is to operate the lever-controls of the tractor, running his train of cars up to the pile.

With every train of three cars, one man does the work of six.



To Strop Safety-Razor Blades

MANY men who shave themselves now prefer to do it with the little safety razor. The only disadvantage attaching to this has been the necessity of keeping on hand a supply of new blades; for, unlike the old-style razor of our grandfathers' day, it was not possible to sharpen the blade. Now, however, there is an invention that makes it easy to strop safety-razor blades.

The apparatus is made of wood and consists of two parts arranged scissors fashion one above the other. One of these carries two pins that accommodate the razor-blade, while the other has two slots that allow the device to be closed.

In addition to the use originally planned, its ingenious inventor discovered that by keeping the blade in the apparatus the razor could be used in the manner of the old-style razor.

"Shines" Flow from This Brush

SHOE-BLACKING and ink are not unlike in many respects; hence it is not surprising that a fountain-brush for shoe-blacking has been invented. The blacking is contained in a metal tube to which a small brush with a hollow handle is attached. At the point where the tube and handle meet is a push-button that controls the flow of the blacking into the brush.

The picture below shows the fountain-brush in action. As the user presses the button with his thumb, the blacking is released. The tube is air-tight; hence the blacking within cannot evaporate.

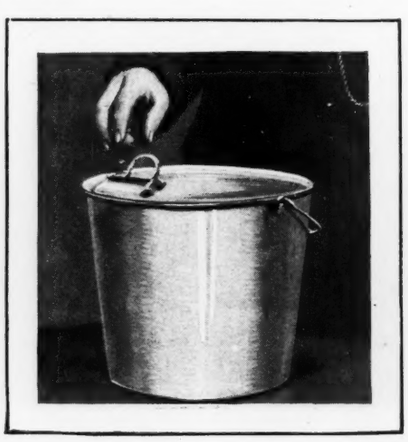
It Floats and Is Sanitary

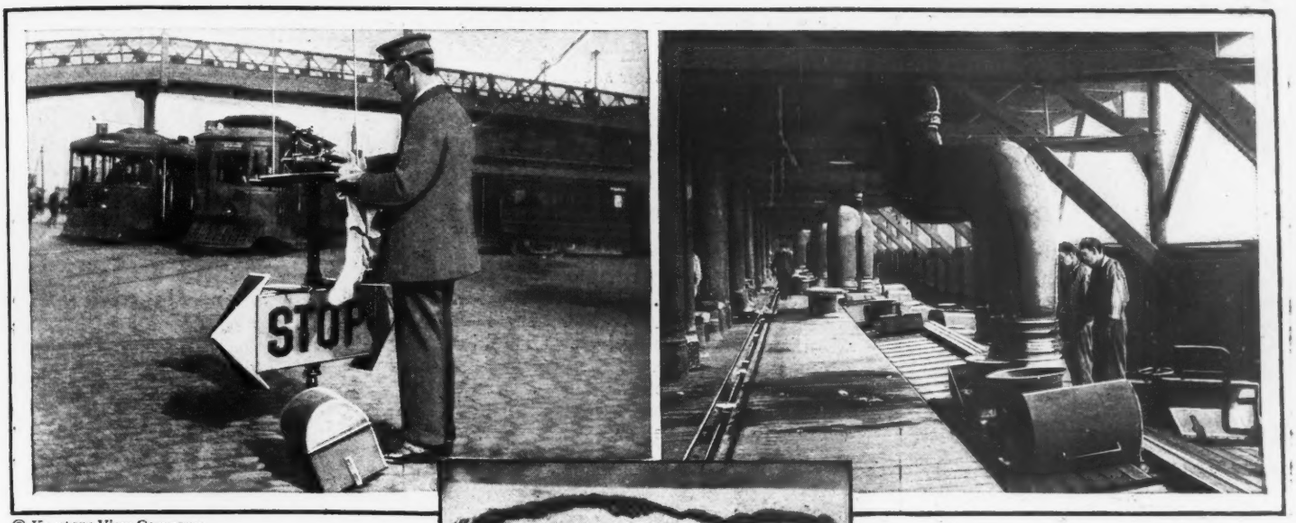
ONE day James W. Carrico saw his young son thrusting his arm into a pail of drinking-water and fishing for the cup. The boy was wet up to the shoulder, and undoubtedly the water was the richer by a few thousand germs.

It was right there that the idea of the unsinkable cup was born.

Outwardly Carrico's cup looks like any ordinary tin cup. But it has an airtight compartment on the handle side that occupies about one fifth of the cup's diameter. It is this airtight compartment that keeps the cup afloat, and the compartment having been placed on the handle side of the cup, naturally it is that side that stays uppermost in the water.

The principle is the same as that employed in shipbuilding, where airtight bulkheads are used to prevent a ship from sinking.





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Traffic Cops in San Francisco Merely Push a Button

SAN FRANCISCO has its own peculiar traffic problems. Here is a device that has been invented to help the San Francisco traffic "cop." It is motor-driven, and when the traffic policeman wants the traffic to stop or pass in either direction, all he has to do is to push a button When he pushes this button, the motor turns the sign and at the same time blows a whistle.

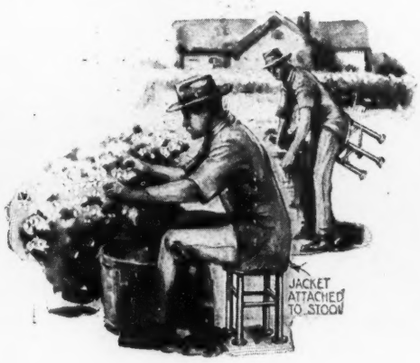
When the machine is in use, it is suspended over the center of the street by two small cables. In the picture above it is shown being cleaned and made ready for the day's work.

He Wears His Chair

THE chair jacket pictured below is the invention of Jeremiah Holliday, of Winnsboro, South Carolina. It is intended for workers who must move from place to place and carry their chairs or stools with them. A circular chair seat with supporting legs attached to it is fastened halfway round to a canvas jacket. The front of the seat has two deep grooves in it to make room for the wearer's legs when he stands up. Corresponding cuts are made in the jacket to enable him to sit down with ease.

The jacket opens up the front, and the wearer gets into it just as he would get into an ordinary coat. After he has buttoned it, he fastens the ends to a projection on the chair.

The chair needs no adjusting and will fall in line when the wearer changes his position.



Hungry Caterpillars Make Up This Moving Circle

PROCESSIONARY caterpillars will go round and round in a circle until they drop exhausted, because they haven't much sense. These caterpillars usually travel in a procession, one of them becoming the leader and the others following blindly. As they travel they spin a fine silk ribbon that guides them when they wish to return home. Any caterpillar may become a leader. But suppose the beginning and the end of the procession meet, thus forming a circle—what happens? The leader is lost and the caterpillars travel blindly in a circle, following the silken thread—sometimes for days.

Henri Fabre, in his book "Life of the Caterpillar," tells of an eight-day procession around the edge of a vase. After the caterpillars had climbed to the rim he removed the silken thread which they had spun on their way up the side of the vase. In regard to this Fabre says, "The caterpillars in distress, starved, shelterless, chilled with cold at night, cling obstinately to the silk ribbon, covered hundreds of times, because they lack the rudimentary glimmers of reason which would advise them to abandon it."

Why You Should Not Melt Butter

BUTTER suffers considerably when it is allowed to melt in the air. This discovery has been made by an Englishman.

The important vitamine in butter, which scientists call the "fat-soluble A," is completely destroyed, even at the low temperature necessary to bring the butter to a molten condition.

The same vitamine that is in butter is also present in milk, and this brings up the question of the advisability of heating milk in the Pasteurization process.

How the Fruit Train Can Be Cooled

REFRIGERATION of freight-cars is of great importance from an ice-conservation and expense standpoint. Unless the cars of fruit are properly cooled before starting on their transcontinental trip, it is necessary to replenish the ice-bunkers three or four times in transit.

The reason for this is that fruit is warm when loaded into the car and much of the ice is consumed in lowering its temperature. Where the cars are pre-cooled, this difficulty does not develop.

Special cold-blast pipes, which are adjustable over the hatches of the ice-bunkers, are used in pre-cooling the cars and their cargoes, the cold air emanating from ammonia plants in special refrigeration systems located at terminals.

Wheeling the Baby Electrically

WHEELING a baby-carriage uphill is tiresome work; hence we now have the electrically driven carriage. It was invented by a Scottish clergyman named Mackenzie. The battery-box that supplies the power is located under the body of the carriage, and a series of chains and sprockets sets the carriage into motion.

It travels slowly forward and is guided by the nurse at the handle. When she wishes to start or stop the carriage, she pulls a switch-lever. A rope leading from the handle to the rear end of the carriage is a sort of friction brake, enabling the driver to reduce the speed of the carriage without stopping it.

Three-Point Suspension for Trousers

USUALLY there are six buttons for suspenders on the edge of a pair of trousers. But are all these six necessary? An English tailor thought the matter over and decided that three would do the work just as well. Whereupon he constructed the trousers shown above.

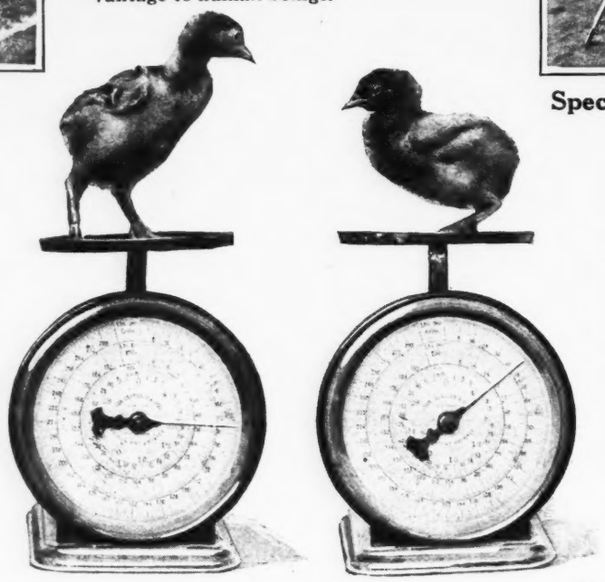
Instead of the usual straight waistline there is a pointed piece of material attached at the back. One button appears on the point. In the front the same sort of thing happens on each side. Thus the three buttons do the work that six did before.

Balanced Rations for Chicks

ONCE upon a time, two tiny chicks broke through their shells at the same moment and fell into the hands of the Department of Agriculture. One chick was fed properly—his rations being carefully balanced. The other chick was fed the way the average farmer feeds his chicks—that is, in a haphazard fashion.

What happened? At the end of five weeks the chick fed on a balanced diet weighed nearly nine ounces, and the other one weighed but five.

Chickens and people differ very little when it comes to physical growth, and the experiment of the Department of Agriculture described above for the benefit of the chicken-breeder could be applied with advantage to human beings.



Specially Made Shoes to Wear on the Beach

IN the picture is a little maid digging for shellfish that hide themselves in the sand. She is wearing beach shoes that are reminiscent of the clogs and pattens of the old world, although the principle of a wider surface to give greater security on soft ground is certainly taken from the skis of Norway.

These shoes are worn by beach workers on the west coast of England where there are quicksands. People who live near such places literally have to watch their step, and the centipede shoes make it easier to do so.

Take Your Own Camp Grate

BUILD a fire in the woods and cook your dinner on it—that sounds very tempting; but unless you carry some sort of grate with you it will be a difficult undertaking.

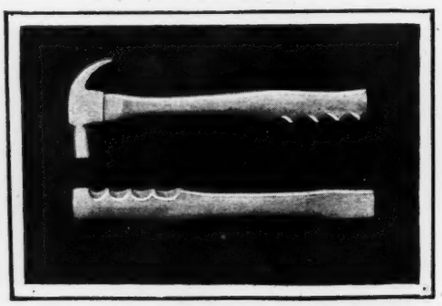
The camp grate shown below is made of metal and is mounted on four legs that sink into the ground. One end of the grate is for pots and pans; the other end is used for frying. There are metal side curtains to prevent the wind from spreading the fire and to concentrate the heat under the food.

We Now Have the Notched Hammer Handle

DID a hammer ever fly out of your hand? If you take a heavy stroke and you have a light grip, the hammer is apt to fly from your hand with considerable force. And if any one is standing in the way of it—well, some one will be hurt.

You can use this hammer with no danger of its leaving your hands. Notches are cut in the handle to accommodate your fingers. It is not necessary to grip the hammer handle so tightly. The notches, therefore, considerably reduce the fatigue of the arm muscles.

You can actually do more work with this hammer than you could with the ordinary hammer that for so many years has held its place in the toolbox.



This Fan Fits Any Socket

THERE is now a small electric fan that will screw into any electric-light socket. It is threaded at the end like an electric bulb, and can be moved from place to place as easily. The fan blades have a metal guard around them to protect the fingers from possible injury.

The picture below shows the fan attached to an ordinary desk-lamp fixture. It can be twisted to any desired angle, since it is flexibly connected with the threaded end.

If desired, the fan may be operated at the same time as the light is being used, simply by providing a double bulb socket.

Special Memorandum Pads for the Blind

SHAPED like a waffle-iron is the new aluminum memorandum pad for blind people. A piece of paper is placed between the corrugated sections before they are brought together. The pad is then ready for use.

When the blind man wishes to make a note of something, he takes a small metal punch in one hand, the pad in the other, and punches holes in it, guided by perforations in the upper corrugated section. Thus the paper is pierced, and small raised points appear on its under side.

The blind man punches the holes in accordance with the alphabet for the blind. When he runs his fingers over the raised points, he reads off what he has written.

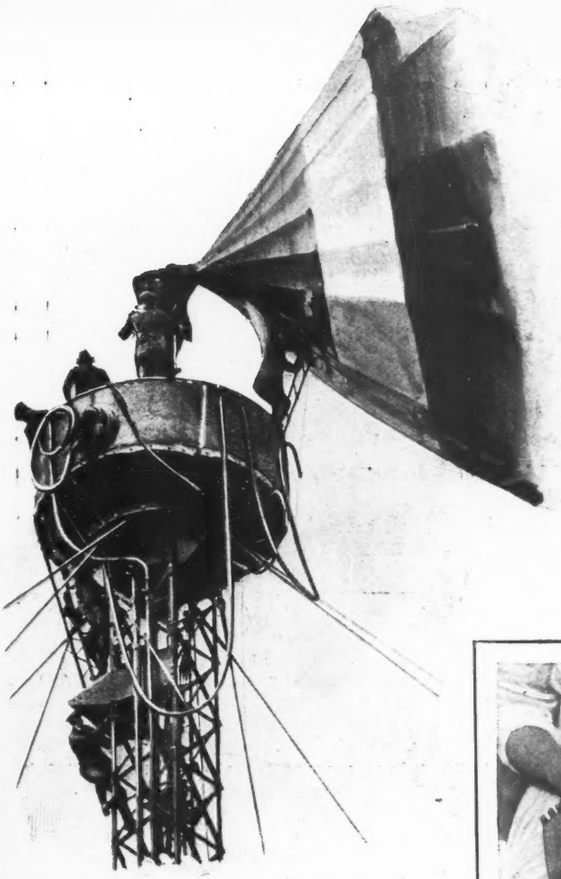
The blind have many friends. Witness the number of inventions continually being brought out for their benefit.

The Fireless Cooker Field Oven

THE fireless cooker, which has made its appearance in many homes, is now being built on a larger scale in Russia. Professor Rotatiyow has constructed a field oven for use in Russia's many wars. It is built on the fireless-cooker principle.

The oven proper is surrounded with insulating material that prevents the heat from escaping. Hence, after the oven has reached the proper temperature fuel is not needed for several hours.

This fireless oven not only saves fuel, but it also saves considerable coal-shoveling, and any cook of any household will testify as to the immense amount of watchful care saved.



Airships Are Now Moored to Mastlike Structures

NOT so long ago the idea of building mooring-masts for airships was considered fantastic. And yet they are actually in use to-day in Pulham, England.

Great difficulty has always been encountered in handling dirigibles on the ground; frequently they have been dashed to pieces by strong winds. Their immense size as well as ground gusts have made the mooring problem a hard one.

Mooring-masts enable airships to swing in the breeze like a weather-vane. Airships have been tethered to mooring-masts for periods of six weeks in all kinds of weather.

The picture above shows the actual point of contact of the dirigible R33 with the new mast at the Pulham airship station. The crew boards the dirigible by a ladder.

By Their Beads Ye Shall Know Them

MOST of us have read of babies who were changed in the cradle and of the confusion arising therefrom; the subject has long been a fruitful one for story-writers.

A certain maternity hospital in New York city is doing its best to avoid such accidents by a very simple scheme. Lettered beads are strung into a necklace for every new baby, spelling its name, so that there is no possible chance for its identity to be mistaken. To make assurance doubly sure, the ends of the string that holds the beads are sealed.

The sex of the baby is indicated by the color of the beads—blue for a boy and pink for a girl.

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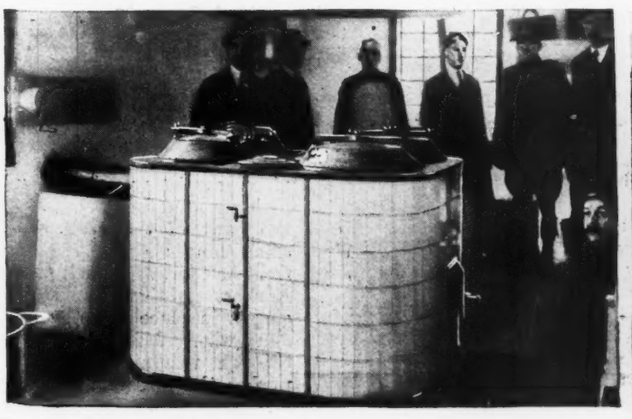
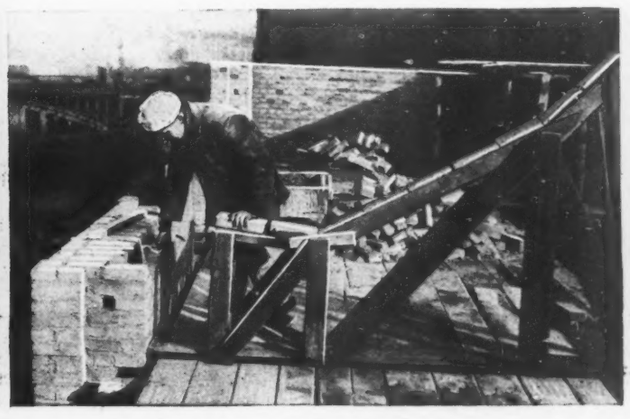
Easy Days for the Bricklayer

"ONE brick in the hand is worth two in the pile," so this bricklayer thinks. To speed up his work he made a small wooden shoot and the bricks slide down the incline into his hand.

There is always a brick ready, and the bricklayer does not have to bend over to pick it up. His helper sends the bricks down. This is better than making the helper pile the bricks up at his side. It also saves the use of the hod. The bricks are conveyed to the upper floors by a small hoist.

This brick-delivering device is the invention of Major Frank Gilbreth, the American efficiency expert.





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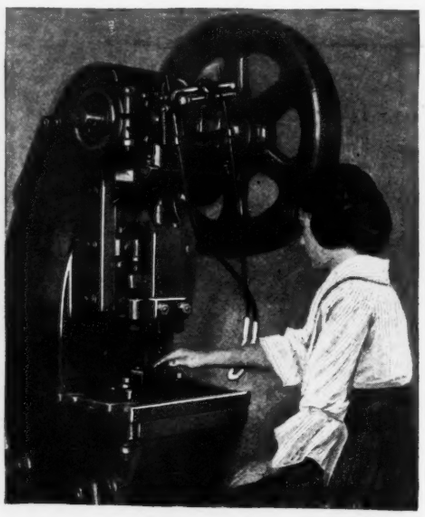
He Is Planning New Designs

FIGURED cloth of the cheaper grades is printed like the colored edition of your Sunday newspaper and the paper on your house walls. A copper printing-roll is used for each of the colors. There are as many rolls on the printing-press as there are colors in the cloth to be printed.

The designer in the illustration above is shown planning and drawing patterns that it is hoped will please the taste of women on the lookout for attractive materials.

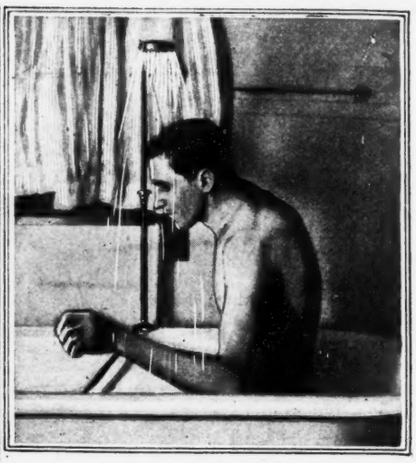
Woven designs are used for the more expensive fabrics, but they are planned in the same way by the same men who plan the designs for the cheaper textiles.



Safety Guard for Punch-Presses

PUNCH-PRESSES have clipped off many fingers and not a few hands. Since workmen's compensation acts have been placed in effect in many of the states, manufacturers have taken greater care to see that machinery is well guarded. If they do not guard their machinery properly, their compensation insurance increases.

Above is shown a new press guard that makes a sweeping motion across the front of the press just before the die descends. If the operator's hands are in the way or under the die, they are brushed aside before the die strikes. This guard has been used for three years, and it is claimed that no accidents have occurred with its use.



A Shower to Fit Any Bathtub

EVERY bathtub can have a good shower-bath when this little attachment is affixed to it. It is held to the side of the tub by a small clamp, and connection is made with the faucet with a small length of rubber hose.

The height of the shower is adjustable and it will swing into any position desired.

When a bathtub seat is used with the attachable shower, all the pleasures of a regular shower-bath can be enjoyed. It may be used also for washing the head without the necessity of getting into the tub. The temperature of the water must, of course, be regulated at the faucet.

Trying Out Goggles in Front of a Fan

NEVER buy goggles until you have tried them out in the wind. But will the dealer let you do this? One wise dealer has put an electric fan on the counter of his store and he turns on the breeze whenever a customer buys a pair of goggles. By standing directly in front of the fan the wearer is able to tell whether the particular pair he has on is suitable.

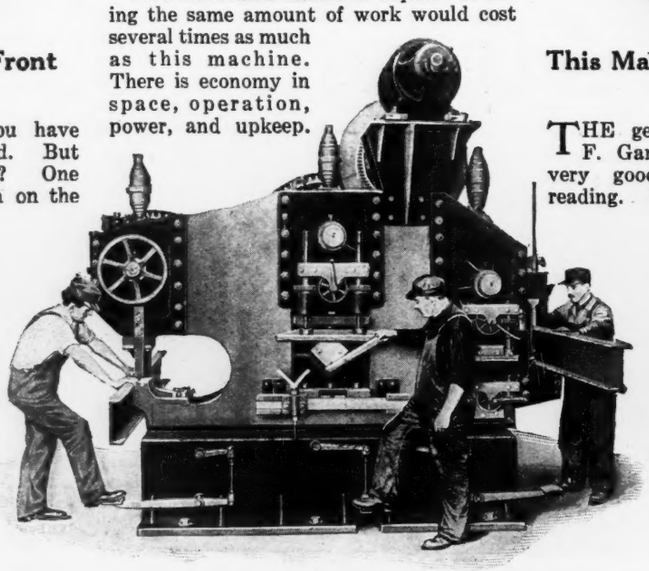
If the buyer owns a motorcycle and expects to dash through sandy places, the man behind the counter will obligingly drop a bit of sand in front of the blades of the fan. No contingency that can be foreseen is neglected.

Five Jobs Accomplished on One Machine

SHOWN below is a machine that will keep three men busy, although they may be doing different jobs. It will do shearing, coping, notching, section-cutting, and punching.

Five separate machines are combined in one unit and driven with the same motor. Each unit of the machine is independent of the other units.

Five individual machines capable of doing the same amount of work would cost several times as much as this machine. There is economy in space, operation, power, and upkeep.



This Man Never Has to Hunt for His Glasses

THE gentleman in the picture, Isaac F. Garner, of Calera, Alabama, has very good eyesight except for close reading. When he wore glasses dangling on a cord, they were frequently broken; when he put them away in a case, he was always losing the case.

So he rigged up a headpiece consisting of a band fitting around the forehead and the back of the head, with small hinges connecting the front half with the back piece. A short rigid arm holds the glasses in place when in use, and when Mr. Garner is through reading, he merely pushes the glasses up on his forehead.

This Flashlight Works with Air

FLASHLIGHTS are used to take photographs in dark places. The flashlight supplies the "actinic" light that is necessary for successful pictures. Certain substances give off a great amount of this light when they burn. The metal magnesium is one of these substances. When brought to a certain temperature, magnesium will burn rapidly—almost explosively.

Magnesium powder is used in the flashlight holder here pictured. The powder is blown into a small flame. Blowing into a small rubber tube raises the magnesium powder from the hollow handle and sends it into the flame, which then produces a light that is rich in actinic rays.

It Sifts Ashes by the Ton

THE machine shown below gobbles up ashes by the ton. The ashes are thrown into a revolving drum at the back of the machine. The very fine particles fall through and the larger particles pass on to another drum with larger meshes.

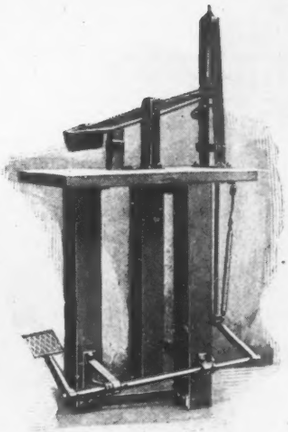
Here another separation is brought about and the large pieces fall into a screw conveyor that revolves in a liquid medium. These conveyors are located in the inclined tank. Here the heavy matter, such as the clinkers, sinks into the liquid, and the lighter matter, such as the partly burned coal, is lifted by the conveyor to an outlet on the opposite side.

Dangling from the Bicycle She Lowers Center of Gravity

AT first glance this looks like one of the most daring feats ever carried out in midair.

Harry Peil, a European gymnast, recently thrilled a great crowd of people with his tight-rope bicycle trick. He rode across a street, from one high building to another, with a woman dangling from the end of an iron pipe attached to the bicycle.

Although the trick appears very hazardous, it is not so dangerous as it looks. The woman hanging on the end of the iron acts like the lead keel on a sailboat. She provides a low center point of gravity that makes it practically impossible for the bicycle to tip over. If the iron pipe were shorter, there might be another story to tell.



For Chopping Wood with Your Feet

WOULD you rather split wood with your hands or with your feet? Which would fatigue you more?

One inventor believes that you should be able to chop wood better with the strength of your feet, and for this reason a machine similar to the one pictured has been brought out. It is operated by means of a foot pedal.

When the foot pedal is pressed, the heavy blade, mounted on an arm, moves downward with considerable force. The piece of wood to be split is held under this blade. When the foot is taken off the pedal, the blade returns to its normal position.

Carry Your Hangar with You

IT goes without saying that airplanes must be protected as much as possible from the elements. Sun, wind, and rain all help to shorten the life of a machine, and yet an airplane hangar is not always available.

This has led an inventor to design a portable canvas hangar that may be carried by the aviator. It is really a tent that may be rolled up into a small bundle and carried in the fuselage of the machine. Celluloid windows are provided and doors that roll up are placed in the sides.

The tent-hangar can be taken out of the machine and put up in half an hour.

Is the Movie Way Quicker?

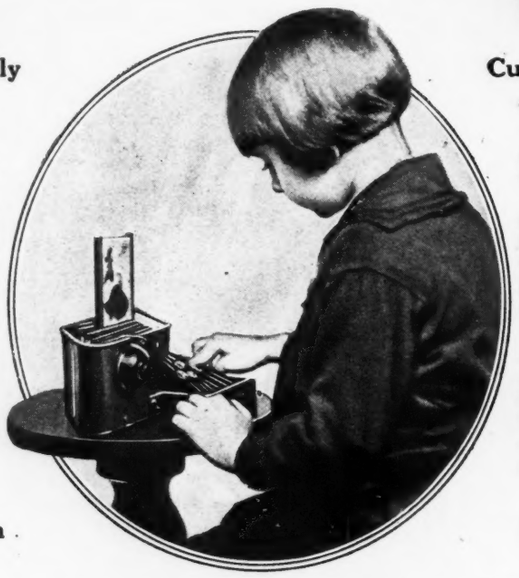
SEVENTH- and eighth-grade classes in nature study in a school at Evanston, Illinois, were recently asked to vote their preference between the text-book and moving-picture method of instruction. The movies received 170 out of 180 votes.

Basing her conclusions on written lessons, their science teacher reported that her pupils learned more about the Monarch butterfly in a fifteen-minute moving-picture than they did about the Black Swallowtail in six thirty-minute text-book lessons with the aid of actual specimens.

Hair Is Now Singed Electrically

WE are told that hair should be singed regularly to remove split ends; but heretofore singeing has been done with waxed tapers and there has always been the danger of burning the hair.

Now, however, there is an electric singeing device, shown in operation in the picture above. It is made of aluminum and has two arms joined by a thin quartz tube containing a resistance coil. An electric switch in the handle controls the current. When the switch is turned on, the tube becomes red hot in ten seconds. Care must be employed by any one using this instrument for the first time.



Curing Hiccoughs with Hot Water

THE pneumogastric nerve is responsible for hiccoughs. When it is agitated it causes the diaphragm to contract spasmodically.

The nerve in question connects the stomach with various parts of the head—especially the ears. Air rushes up the glottis and hits against the epiglottis, causing what is known as a hiccough.

There are several methods used for calming the pneumogastric nerve. The picture above shows one of the latest that is very popular in London. The hiccougher puts his fingers in his ears while some one gives him hot water to swallow.

He Whittled a Portière from Strips of Pine

HERE is a man who must have a great deal of patience. It took him six months to whittle out this portière with his trusty old jackknife.

Each of the lengths seen in the picture was once a long piece of white pine. The links of the chain were whittled out, and each one is a whole piece of wood without joints or flaws.

At the top of each chain is a little round ball in a little cage that forms the upper terminal. The other end of the chain is ornamented with a carefully carved acorn. Thirty-five chains make up the portière.

This man has made many other objects of art and usefulness from white pine.

Making the Alphabet Interesting

NO longer need the alphabet be taught in a monotonous singsong manner. It can be made interesting. Here you see a new alphabet machine that is really a toy.

The child punches a key and a card springs up in front of him. On the card appears a large letter corresponding with the letter on the key punched, and a picture of some animal whose name starts with the letter in question; for instance, the letter "L" and the picture of a leopard.

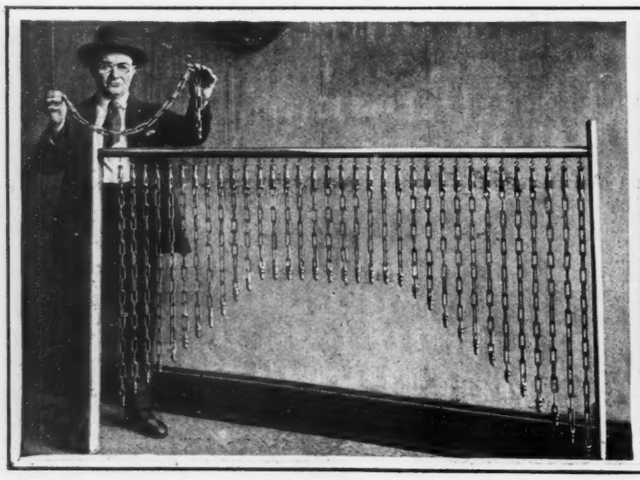
Every time a key is punched a bell rings—an added attraction. As soon as the key is released, the card it governs falls back into place.

The Whole Family Tricycles on This Machine

BELOW you see a bicycle for an entire family—provided the family numbers no more than three. An enterprising father made this three-passenger tricycle, on which the whole family can take its Sunday ride together.

It will be noticed that dad takes the lead. When a hard hill is approached, probably he has a pretty tough pull of it. One could readily imagine that with the three cyclists pedalling steadily a fairly good speed would be attained. It would not do, though, to depend too much upon the youngest member.

The two rear wheels are connected with the back of the first bicycle by a small iron pipe. The rear handle-bars on the rear wheels serve merely to prevent fatigue. They are not used for steering.



© Gilliams Service

Steel Cables Drive This Bicycle

THE chain that appears on most bicycles has been dispensed with in the unusual looking model shown above. In place of the chain two thin steel cables are employed to transmit power to the rear wheel.

To propel the ordinary bicycle it is necessary to bend over. Bending over is not necessary on this machine; the rider may seat himself as in a comfortable chair.

He presses his feet downward on the pedals, and this unwinds the thin cable from a pulley on the axis of the back wheel. This happens at the time the cable on the opposite pulley is winding up.

Making the Barrel-Head Stay On

HERE is a little tool used in placing barrel-tops.

The hoop that holds the top of the barrel in place is pulled tightly about the barrel before the final rivets are put in place. If this hoop is not put on tightly, the barrel-head is apt to come off during transit, with results that can be imagined.

This tool grips both ends of the steel hoop. By means of the lever the ends are pulled together and held until they are secured.

With this tool a man can place heads on barrels very quickly, and they are on to stay.

Golfers, Here Is a Device that Casts the Tee

CAREFUL golf-players take great pains to see that the tee upon which the ball rests is made just right. The sand is carefully piled up into a small mound and the ball is laid on the peak.

With the aluminum device below a perfect tee may be made very quickly. The moist sand is placed in the cone-shaped cup and packed down tightly. It is ejected merely by pressing on a small plunger at the top with the thumb.

After the sand has been pushed out, the plunger is forced back to its normal position by a spring.

The device is made of aluminum to prevent the moist sand from sticking to the sides of it.

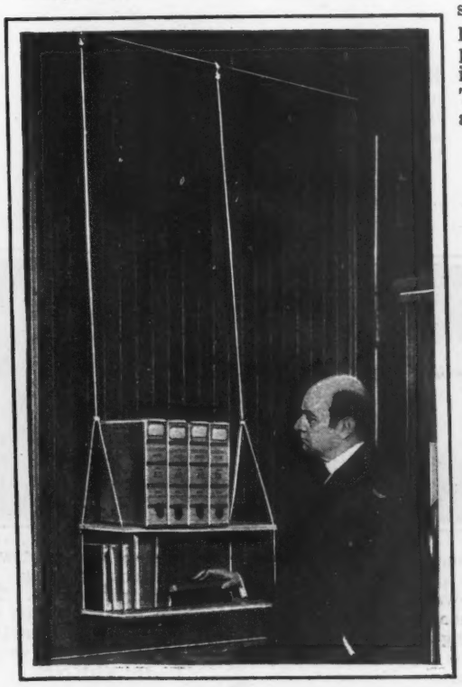
Hang Shelf Like a Picture

DID you ever try to put up a shelf? Did you ever have the pictures in the next room fall off the wall through your hammering? Or did the plaster come down in lumps?

No more need you have troubles such as those.

Below is a shelf that hangs like a picture. Take it out of the box and you will have it hanging on the wall in five minutes. The stepladder is all that is needed.

The shelves are made of pressed steel nicely enameled and held with thin steel cables. The distance between the shelves is adjustable.



How London Builds Her Roads

AN English inventor has brought tar-paper into use in road construction. Wooden blocks are first laid in the usual manner and covered with a heavy coating of tar. Heavy tarred felt is then placed over the bricks. This carpet is fastened to the wooden blocks with nails. After this, another application of tar is made and a sand-and-cement dressing is placed over it.

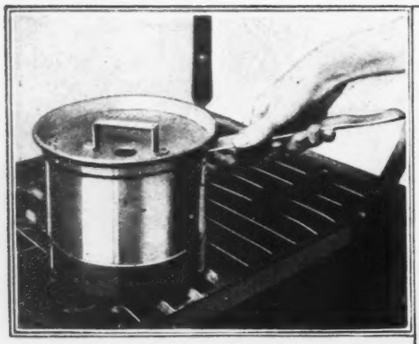
This carpeted road has been used on a Thames river bridge in London for several months and it shows little signs of wear. It is, of course, important that road-mending in large cities be reduced to a minimum.

Strengthen Merchandise Barrels with This Brace

MANY millions of dollars' worth of merchandise is lost annually by the collapse of barrels and boxes during shipment. Barrels containing heavy substances such as sugar and cement are very apt to break and spill their contents if they are handled roughly.

A crushing force applied to the center of the barrel strikes it at its weakest point, since there is nothing there to offer support. William F. Meek places two supports in the center of the barrel to prevent it from breaking during transportation. The cost of the supports is small, since they are made of wood.

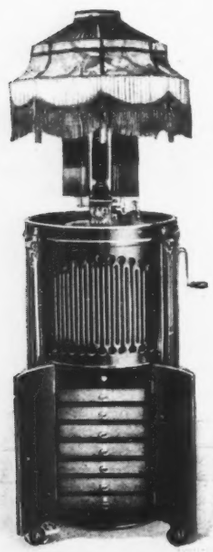
Housekeeping Made Easy



The contents of this pot can't boil over. Why? The lid is perforated throughout; as the liquid boils it rises through the perforations and then runs back through a hole to which a floating valve is attached

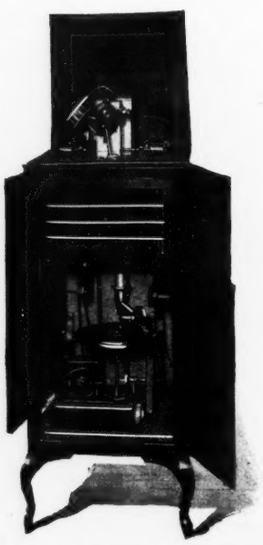
Why tire yourself whipping cream, beating eggs, or mixing light batters? There is now an electric attachment that will do the beating for you. A lever controls the starting and stopping, and regulates the speed of the blades

Here is a can-opener equipped with a cogwheel for guiding the knife. The wheel travels along the side of the can just below the rim; the knife easily cuts through the top of the can



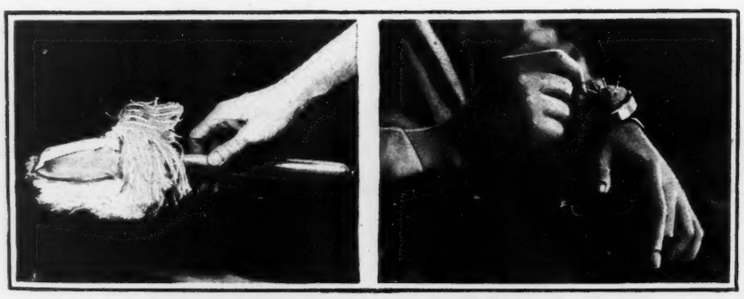
The floor-lamp and the phonograph are here combined. The lamp is fastened to the lid of the phonograph. There are two hinged sections that can be swung upward when you wish to put on a record

Rubber bulbs on atomizers are apt to dry up and crack. Hence we now have the metal bulb shown above. It consists of two telescoping cylinders of aluminum. A spring returns the outer cylinder to position



The lower part of this phonograph cabinet contains the mechanism and the turntable. What's in the upper part? A moving-picture machine. Thus you can have movies and music at home at the same time

Four sharp blades twirled inside a grapefruit will cut out the tough, seedy center. You need not touch the grapefruit at all during the process



A bag of soap in the dish-mop will create plenty of suds for your dish-washing. Any odd pieces of soap—even the stub of a shaving-stick—should be put in the bag, eliminating any wastage

Instead of a wrist-watch, the dressmaker now wears a wrist pincushion. The cushion is mounted on a flexible metal bracelet that is snapped in place on the wrist. It is loaded with pins

Inside the spout of this coffee-pot is a strainer that can be taken out and washed every time the coffee-pot is washed

Keeping Up with the March of Science

Facts for the man who wants to know

Gasoline Graded by Color

SEVERAL grades of gasoline are in the market, greatly differing in their effectiveness, but so similar in appearance that even the eye of the expert cannot detect the difference. Since the prices are graded according to the quality of the gasoline, dishonest dealers make considerable extra profit by selling to their transient customers inferior gasoline at the price of superior grades.

Several important producers of gasoline in England and elsewhere are considering the plan of giving to each grade of their product a distinctive color that will make it possible to distinguish it at a glance. A method has already been evolved of so coloring gasoline that it can easily be distinguished. The coloring has no deleterious effect and causes no sediment. Any attempt to mix or blend two or more grades would be detected by the alteration of the shade.

Why Car-Wheels Break

THE breaking of wheels of railway-cars is a frequent occurrence. It constitutes a serious menace to life and property and at the same time an important item of expense.

The Bureau of Standards undertook an investigation of the cause of breakage, and after exhaustive research ascertained that the relative overheating of the car-wheels at their periphery by the prolonged application of the brakes while descending long grades was principally responsible for the breaking of the wheels.

The overheating caused strains due to unequal expansion between the peripheral parts of the wheel and the cool central parts which only twelve of the twenty-eight wheels tested could withstand without breaking.

Forms of Color-Blindness

COLOR-BLINDNESS, a natural and congenital defect, has three distinct known forms—total color-blindness, in which color cannot be distinguished at all, but only light and dark; partial color-blindness, in which red is mistaken for green, or black for brown; and a form in which the afflicted person can discern the primary colors but not intermediate shades and frequently is unable to distinguish between blue and violet. It is a remarkable fact that persons afflicted with color-blindness often have better, clearer vision than persons not so affected.

It is estimated that in England four per cent of the male population is afflicted with color-blindness, but only one half of one per cent of the female population. The percentage of color-blind individuals is especially great among Jews and Quakers. The defect often runs in a family for many generations, and, although it is confined to the male members, it is transmitted through the females. The daughters of color-blind men invariably have color-blind sons.

The cause of the defect is not yet definitely known. Temporary attacks, arising from old age, the use of drugs, alcoholism, and excessive smoking, are sometimes cured; but no remedy is as yet known for the congenital type of color-blindness.

Beautifying Concrete Houses

HOUSES built of reinforced concrete undoubtedly offer many advantages, but the naked ugliness of their outside offends our esthetic sensibility.

An English architect, Professor Beresford Pite, in a recent lecture, strongly advocated the covering of houses of reinforced concrete with glazed or unglazed ceramic tiling of any desired color or shade. Such tiling, Professor Pite contends, would materially improve the appearance of concrete houses, and, being impervious to moisture, would give additional and permanent protection to the structure.

Can Seasickness Be Cured?

IF anybody asked you what kind of waves cause that terrible sensation known as *mal-de-mer*, you would probably say it was the short, choppy variety. But you would be wrong. It's the long, billowy kind that does the damage.

This has been determined in the National Physical Laboratory at Teddington, England. Here a band of public-spirited workers are doing their utmost to discover the secret, and at the same time the cure, of seasickness.

To carry on their research, they have a wave-making machine equipped to produce electrically all the kinds of waves known to seafarers. The waves are produced in a 750-foot tank, and the velocity and volume of each wave are carefully measured, as well as the effect on wax boats sixteen feet long. These measurements are recorded by extremely sensitive instruments.

The object of all this experimentation is to determine what kind of ship can successfully combat the action of seasickness-producing waves.

Magnetic Steel Tests

TESTING steel for the presence in it of cracks and air bubbles has heretofore been a difficult and complicated operation, consuming much time. Recently a new method, invented by an English engineer, was tried out with great success.

The steel block to be tested is immersed in petroleum that contains very fine iron filings in suspension. The small particles of iron are attracted by the residual magnetism in the steel and adhere to the block. Where there are bubbles or cracks the lines of force formed by the filings will show breaks and dark portions.

Corncobs Have Their Uses

ONLY a few years ago the farmers in the corn belt of the United States considered corncobs as useless and undesirable refuse. They used them for fuel, but only when wood or coal was scarce.

Recently many important uses have been found for the corncob, which is no longer allowed to go to waste. Cellulose, which is the principal component of the corncob, is employed in the manufacture of various explosives.

From corncob pulp certain grades of paper may be made, and a valuable substance, furfural, may be obtained which is used in the manufacture of certain adhesives and forms the basis of a beautiful green dyestuff for silk. It is also an important reagent in the chemical laboratory.

Deceived by the Eclipse

STANDING in a corner of the Croydon aerodrome in England is a lighthouse that works automatically. When the light of the sun fades in the evening, the powerful lamps of the lighthouse are turned on by a mechanism actuated by the electric resistance of a light-sensitive selenium cell.

When the moon moved across the disk of the sun during the annular eclipse on April eighth of this year, gradually shutting out the light, the selenium cell proportionately lost its conductivity and set in motion the mechanism that turned on the lamps of the lighthouse. As the moon receded from the disk of the sun and the light became stronger, the growing conductivity of the selenium cell soon caused the lamps to be turned off.

Sweet Potatoes Are Valuable

OF the specifically Southern products of the American soil, cotton and tobacco have long ago won recognition in the markets of the world. The peanut is rapidly gaining in popularity and economic importance, and now the humble sweet potato is striving for recognition.

A scientist connected with the Tuskegee Institute for negroes in Alabama has made a special study of the sweet potato, and, as he stated at a hearing before the Ways and Means Committee of Congress, more than one hundred different sweet-potato products have been developed to date, all of them valuable for food purposes.

How Raindrops Are Formed

FOR the purpose of verifying or disproving theories concerning the manner in which raindrops are formed, Dr. W. J. Humphreys made a careful investigation, the results of which he submitted to the American Physical Society at a recent meeting. He expressed the opinion that humid air, ascending, becomes cooled to

the condensation point as it meets colder strata of air. When that point is reached, the water vapor condenses around the nuclei of mineral or organic origin suspended in the air, and forms droplets.

The drops thus formed in the lower part of the cloud attract the greater part of the nuclei carried by the warm air still ascending. Hence the number of nuclei in the upper strata of the cloud will be so small that sufficient vapor can condense around each of them to form a drop heavy enough to fall to the ground.

In their descent many of these drops may combine with others—hence increasing in size and weight. This coalescence is probably facilitated by the electric charge that the drops usually carry.

Some Plants Like the Cold

WHILE some tropical plants freeze at a temperature of about 39 or 40° F., other plants can endure the terrific cold of the arctic winter night without injury. Alpine flowers thrive in the region of snow and ice, developing blossoms, although they are frozen during the night and the greater part of the day and thaw out only for a few hours in the middle of the day.

In Siberia, where the temperature frequently drops to 64 degrees below the freezing-point, many hardy flowers and trees grow in profusion.

More Wood Alcohol

THE destructive distillation of wood produces wood alcohol, together with acetone, acetic acid, and other substances of industrial value. The increasing scarcity of wood and the constantly growing demand for wood alcohol made it desirable to increase the yield of this product. The problem was taken up by the United States Forest Laboratory at Madison, Wisconsin.

After a number of trials it was ascertained that the addition of 1 per cent of sodium carbonate to the wood increased the wood-alcohol yield about 50 per cent, without diminishing the yield of acetone and acetic acid. The wood should either be thoroughly impregnated with sodium carbonate in solution before it is distilled, or, if in the form of sawdust, it should be thoroughly mixed with the dry carbonate.

Sound Location by Birds

NEARLY all birds seem to possess an extremely acute sense of hearing, and some of them have a faculty of determining the direction of the sound.

This is of particular interest in view of the fact that the birds have but a single middle ear, flanked on each side by a drum membrane. Birds also lack the highly developed outer ear of the mammals that is believed to be a great aid in locating sound.

Some scientists are of the opinion that the keener sense of location of sound in birds may be accounted for by the greater efficiency of their eardrums, which are intimately connected with the same middle ear.

Prize for a Humane Trap

THE New York branch of the American Society for the Prevention of Cruelty to Animals offers a prize of $500 for the best humane trap for capturing fur-bearing animals. This effort of the Society to relieve unnecessary suffering of wild animals ought to meet with a wide response.

The competition is open to all. It closes on October 1, 1921. Send your ideas to George Foster Howell, 187 Windsor Place. Brooklyn, N. Y.

Guarding Against Radium

SOON after the discovery of radium it was learned that it possessed to a high degree the power to destroy living tissue. This power is the reason for its extensive therapeutical use as a destroyer of malignant organisms and tissues and at the same time the cause of the serious dangers connected with the handling of radium.

Now that the nature of radium is more fully understood, means have been found to safeguard the life and health of persons treated with radium, and of the scientists, doctors, and nurses handling it.

A patient in an infirmary at Sheffield, England, who was undergoing treatment for cancer of the tongue, inadvertently swallowed the capsule containing the radium with which he was treated. The doctors feared grave consequences, but did not wish to remove the radium by a surgical operation. Instead, they took X-ray photographs of the patient every hour, watching the progress of the radium as it passed first through the alimentary canal, then through the stomach, and then slowly through the intestines. They were ready to operate if the capsule lodged in any spot for more than one hour. Fortunately, the capsule progressed slowly but without stoppage, and was expelled thirty hours after it had been swallowed, without having done any harm to the patient.

To Trace Ground-Water

IT is important sometimes to ascertain the origin and flow of ground-waters, which feed springs, ponds, or swamps or are derived by seepage from rivers, canals, or other large bodies of water. In some cases it may be desirable to ascertain the existence of underground connections between rivers and other watercourses. Usually the most reliable results are obtained by the use of certain chemicals or dyestuffs that are dissolved in the water, are distributed through the underground channels by the flow of the waters and carried sometimes for many miles. The presence of these chemicals or dyes in the water can be determined by analysis or, in the case of certain dyestuffs, by the color which they impart to the water.

One of the most efficient aids in tracing underground waters is fluoresceine, a coal-tar product of brilliant orange-red color, which is easily soluble in alkaline water and imparts to it a brilliant green fluorescence. So powerful is this substance that one part of it, dissolved in 40,000,000 parts of water can easily be distinguished with the naked eye, and with the aid of a long tube of colorless glass even one part of fluoresceine in 10,000,000,000 parts of water can be detected.

Water that contains free acid cannot be traced by this dyestuff, because the acid destroys the fluorescence. For this reason it is not suitable for tracing water percolating through peaty soil. In making the tests, the calculated quantity of the dyestuff is dissolved in a small quantity of alkaline water and the solution is poured in a single charge into the water the underground flow of which is to be ascertained.

All springs and underground waters in the direction of the suspected flow should then be watched and samples should be taken at intervals to be tested for any trace of fluorescence.

Disease Destroys Glass

NOT only animals and plants are subject to disease: inorganic matter also suffers.

The corrosion of metals and the gradual disintegration of rocks and minerals by weathering, dehydration, and direct chemical action do not, properly speaking, belong in the category of disease of inorganic substances. But there are certain other peculiar phenomena, probably caused by the agency of bacteria or microscopic fungi and algae, which may rightfully be considered as diseases. Such phenomena have been observed in iron, steel, zinc, tin, and aluminum, and in certain sandstones, bricks, mortars, concretes, and glass.

Recently it was reported that the famous stained-glass windows of York minster, one of the most beautiful cathedrals of England, had been attacked by a peculiar disease that in time threatens their destruction.

Small holes develop in the glass. These holes grow deeper and cause the surface of the glass to flake. Some parts of the glass have become as thin as tissue-paper and crumble at the touch. Neither the cause of the phenomenon nor a remedy has so far been found.

Room Temperatures

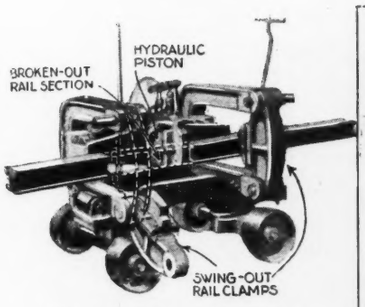
AN expert on heating and ventilating has compiled a table of suitable temperatures.

Living-rooms should be about 68° F., while bathrooms require between 70 and 85 degrees. Sixty-five degrees is sufficient for churches and from 60 to 64 degrees for lecture-halls, while public buildings should have a temperature of between 68 and 72 degrees, and schools about 70 degrees.

For entrance-halls and vestibules a temperature between 54 and 60 degrees is recommended; for gymnasiums 60, for swimming-halls 68 degrees. Hospitals should have a general temperature of between 72 and 75 degrees, sickrooms 72, and operating-rooms from 70 to 90.

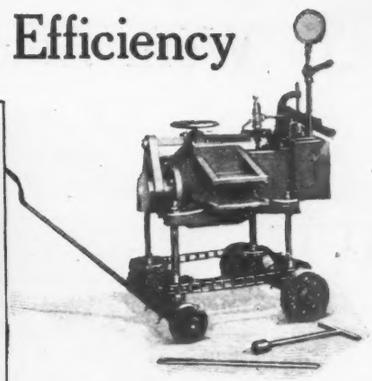
Factories and shops are best kept at 65 degrees; boiler-shops and foundries only require from 50 to 60, machine-shops from 60 to 65, while paint-shops require about 80 degrees. From 50 to 64 degrees is considered warm enough for prisons, probably in order to make them less attractive in cold weather.

Tools and Machines for Higher Efficiency

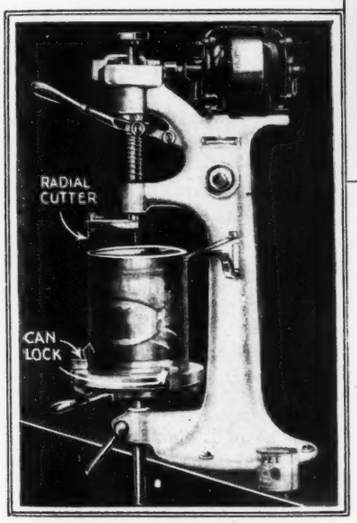


This portable rail-bender is intended for use in railway construction. It has interchangeable formed bending blocks that prevent the buckling of the rails. The yokes are hinged and make it possible to introduce rails sidewise

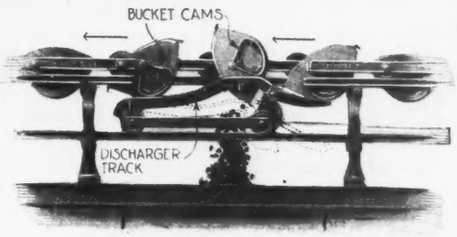
With the machine shown here one operator tapped 700 holes an hour in cast-iron cylinder-blocks. This includes the time required to change the taps to three different sizes and to turn the block



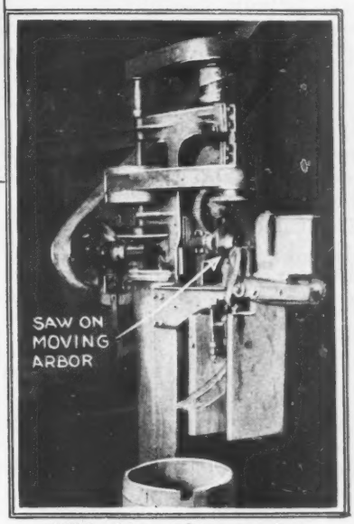
A portable hydraulic press used to extract crankpins in locomotive wheels and other heavy machinery. The ram of the press is sent forward with hydraulic pressure developed by a small hand pump; 150 tons pressure may be developed



Speed, safety, cleanliness, and efficiency are achieved by this can-opener, which will handle cans of one-gallon size or smaller, twelve a minute. The knife does not revolve until in position and a clutch is thrown in

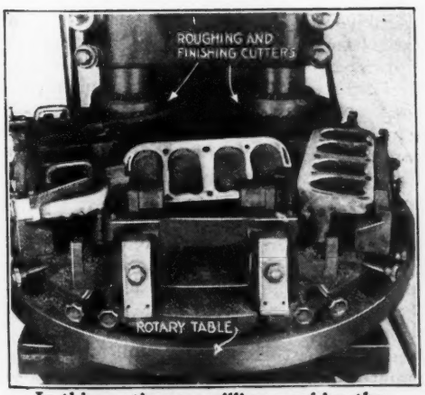


Illustrating the manner in which the discharger, resting on its own track, tilts the buckets of the link-belt coal-conveyor. The flange causes the buckets to tilt



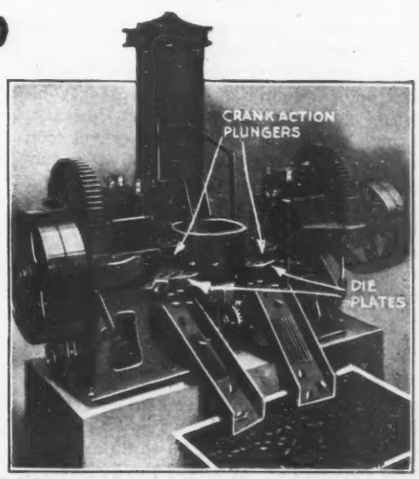
With this machine one hundred wedges can be cut from a block of wood in one minute. The plane of the circular saw has an up-and-down and an oscillating motion

Special steel that takes great hardness, holds a keen edge, and does not scratch, enters into the construction of the hand scraper shown here. The scraper blade is held in position by notched clips and is exchangeable



In this continuous milling-machine the work is clamped to a rotary table. The picture shows automobile cylinder-heads milled from the rough casting. The left spindle is for roughing; the right one is for finishing

Shear gates of the type shown here are used extensively in sewage and filtration plants, where the pressure of the liquid is comparatively light and always in the same direction



Briquettes composed of coal screenings, small particles of coke, and 6 or 7 per cent of a binder are means of fuel-saving. This machine, with a pressure of 100 atmospheres, produces 3000 pounds of briquettes an hour

Worn Automobile Parts Saved by Plating

A remarkable method of repairing machine parts that has unlimited industrial possibilities

By P. J. Risdon

English correspondent of the Popular Science Monthly

WHEN you electroplate, you coat with a valuable metal, such as gold, silver, or copper, an article made of a baser metal. The article to be coated is connected with an electric circuit and immersed in a chemical solution so as to constitute what is called an electrode—that is, a terminal to or from which the electric current flows through the solution. Another electrode, which consists of the metal to be deposited, is immersed in the same bath and connected with the circuit. Switch on the current and a chemical action takes place. Minute particles of the metal are detached and deposited upon the article to be coated until the requisite thickness is obtained. The method is known as "electro-deposition." Similarly, electrolytic copper (which is the purest form of copper) is obtained by allowing the process to continue until solid bars have formed.

This principle has now been applied to the deposition of iron with such satisfactory results that a coating of iron one twelfth of an inch thick can be deposited upon an iron or steel object of cylindrical shape. Because iron so very readily oxidizes or rusts, not only was it difficult at first to secure the adherence of the coating, but even when that was accomplished spots would rust beneath the deposited film.

This led to exhaustive experiments, as a result of which means were evolved for so thoroughly cleansing and preparing the surface to be coated as to insure perfect adherence without fear of subsequent corrosion beneath. This will perhaps be better understood by considering what happens when iron is painted. If an iron bar, slightly rusted, is rubbed so as to appear perfectly clean, and is then painted, sooner or later the paint will scale off in patches where the metal has continued to rust beneath the protective coat of paint. Again, in cheap copper-plated articles rust appears in spots, causing the copper deposit to flake off.

Now painted ironwork can be repainted periodically and coppered articles can be recoppered, but when we come to depositing a comparatively thick coating of iron upon an iron or steel article, we encounter a totally different problem. The primary object in view was to build up the worn parts of motor vehicles to their original size and so avoid consigning them to the scrap-heap.

During the war, when in England and France spare parts were often unobtainable, vehicles were driven until they would run no longer. They were brought into the workshops in a deplorable condition. Bearings had been hammered and packed up. In a case within the writer's personal knowledge all the bearings of a certain car were packed up by strips of match-boxes and newspapers, and that was only one of numerous instances. When such expedients are resorted to, the effect upon gears, for example, is disastrous. Once out of true engagement, gear teeth, which would otherwise give satisfactory service for years, grind and wear with astonishing rapidity.

How to Carry Out the Wonderful Electro-Deposition Process

THE process of depositing a coating of iron that has been successfully carried out in England and France is as follows:

The article to be coated is first cleaned with gasoline to remove all oil and grease. It is then immersed for twelve hours in a bath containing a scalding solution of caustic and washing soda at a temperature of 194° F., after which it is rinsed and cleaned thoroughly with wire brushes. The portions of the surface that do *not* require a deposit are then well coated with a mixture of bitumen and paraffin wax.

The article is next wired up as a negative electrode, and immersed in another solution of soda similar to the first, but at a normal temperature, a piece of sheet iron being used as a positive electrode. A current of from 30 to 50 amperes is turned on for three minutes. The part is lifted out and immediately washed in water before it has time to dry, and then it is dipped for a few seconds in a strong solution of nitric acid (equal parts of acid and water).

Producing the Fine White Surface

It is next made the positive electrode in a cold solution of sulphuric acid consisting of 25 per cent of acid to 75 per cent of water, a current of from 30 to 60 amperes being switched on for about three minutes, reversed for three minutes, and reversed again for three minutes. This produces a fine white surface when cleaned. During this part of the process a porous screen is placed between the article and the other electrode to prevent gas (given off at the negative electrode) from disturbing the solution around it, as any movement of the solution impairs the effect.

When lifted from this solution, the article is immediately washed again in running water and as rapidly as possible transferred to the depositing bath or vat. In this it is suspended as a negative electrode again, the positive electrode consisting of Swedish iron wire of 16 standard wire gage woven into the form of a cylinder and placed in the vat so as to surround the article concentrically. The solution is of ferrous ammonium sulphate at 68° F. It is kept gently agitated, and changed every three or four days.

The time taken to complete the deposit varies from one or two days to a fortnight, according to the nature of the work.

By this means not only is perfect adherence ensured, but, as magnified sections show, the coating is virtually homogeneous with the metal of the article itself, for it is almost impossible to chip it off with a hammer and chisel. The layer presents a smooth surface that can be filed or ground and beautifully polished. An article so treated can be made red hot without deterioration of the deposit.

After completion the deposited layer may be hardened, if required, by a process known as case-hardening, in which the metal is heated and carbonized. Photographs of magnified sections show that in some instances the carbon penetrated through to the original metal, obliterating every trace of any dividing lines.

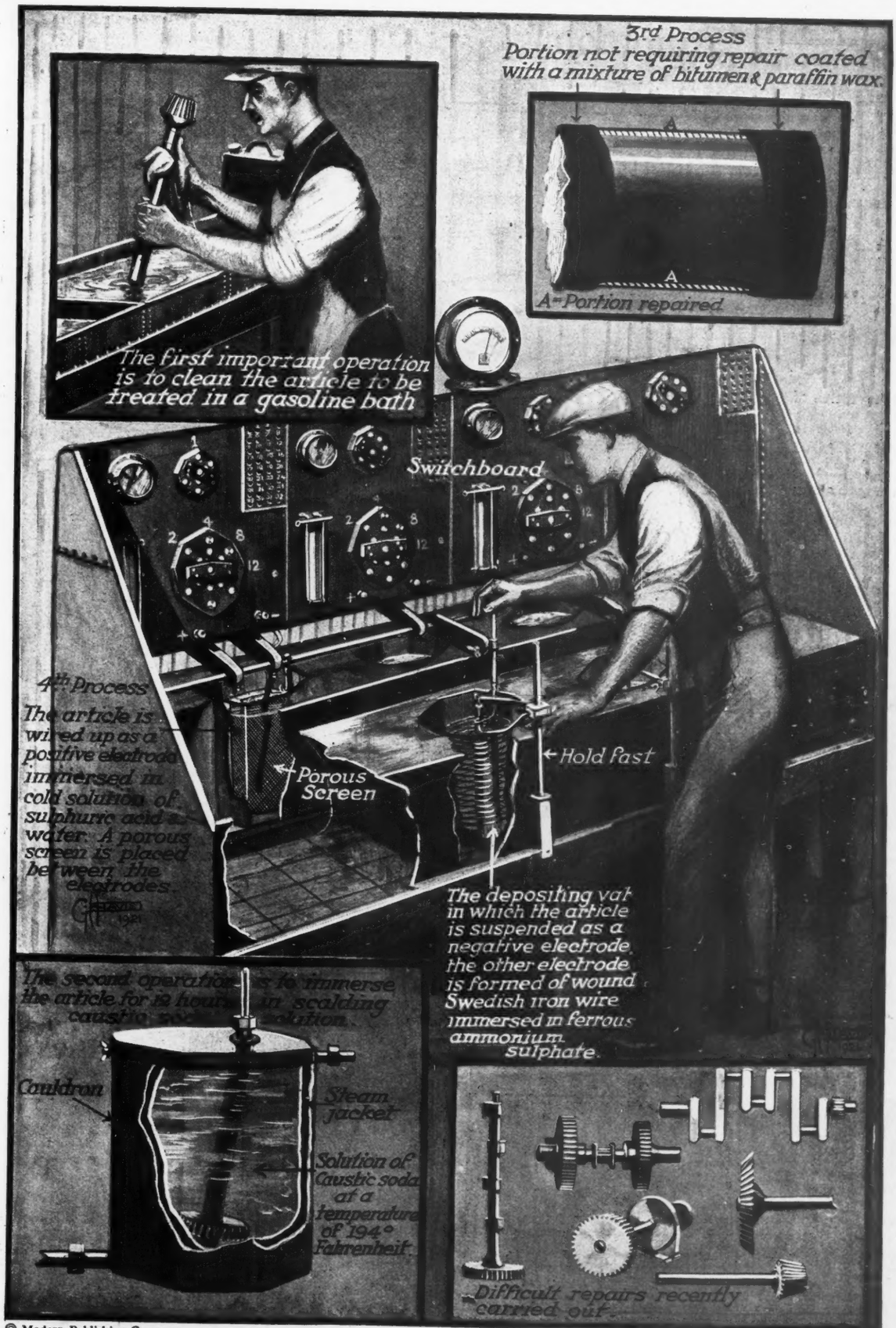
In a small shop of sixteen hundred square feet area the worn parts of thirty-six vehicles a week were satisfactorily repaired, which in six months comprised six thousand different items.

Larger Repairs May Be Possible

In many cases, cars returned for repair a second time enabled examinations to be made that proved that the built-up parts gave satisfactory service. It is hoped that the process may be found applicable to large and to fast running shafts subject to torsion, and to articles of other than cylindrical shape that have hitherto resisted satisfactory treatment.

Among other essentials, it was found necessary to exclude dust and to maintain the shop at an even temperature, since low temperatures caused the deposits to become brittle and to adhere badly. A uniform current density is also of importance to insure continuity of deposit, since variations in the current cause rings of growth.

The variety and number of cleanings that articles have to undergo are perhaps somewhat bewildering and may appear at first sight rather laborious; but it must be remembered that an absolutely clean surface is the first essential for adherence. It required great skill and patience and much experimenting to ascertain the best methods of treatment, and the inventors may certainly congratulate themselves on having achieved something that should prove of great commercial value.


3rd Process
Portion not requiring repair coated with a mixture of bitumen & paraffin wax.
A
A
A= Portion repaired
The first important operation is to clean the article to be treated in a gasoline bath
Switchboard
4th Process
The article is wired up as a positive electrode immersed in cold solution of sulphuric acid & water. A porous screen is placed between the electrodes.
Porous Screen
Hold fast
The depositing vat in which the article is suspended as a negative electrode. The other electrode is formed of wound Swedish iron wire immersed in ferrous ammonium sulphate.
The second operation is to immerse the article for 12 hours in scalding caustic soda solution.
Cauldron
Steam jacket
Solution of Caustic soda at a temperature of 194° Fahrenheit
Difficult repairs recently carried out.

© Modern Publishing Company

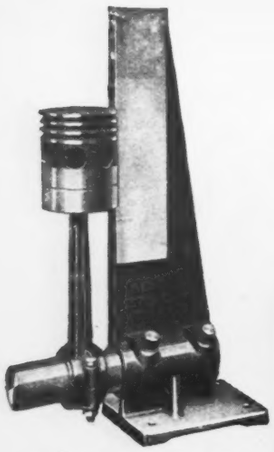
Drawing by G. H. Davis

Electro-Deposition of Iron on Metal Parts

Mr. Davis' drawing shows in detail the process for coating metal with iron now being used extensively in England and France in the automobile-repair trade.

It is possible by this process to deposit a coating of iron of one twelfth of an inch on an object of cylindrical shape. It is necessary first thoroughly to cleanse the article to receive the deposit, after which a carefully worked-out process is followed in which the article to be coated is the negative electrode and a piece of sheet iron acts as the positive

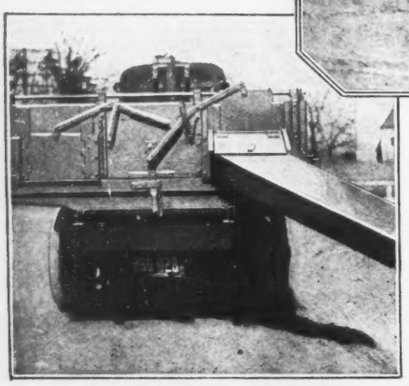
Automobilists—Don't Miss the New Car Accessories Pictured on These Pages



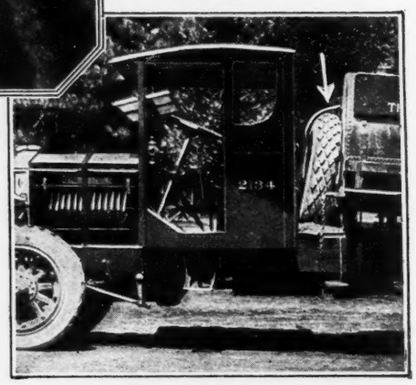
With this invention of a New York manufacturer it is possible to aline pistons and true up wrist-pins with perfect accuracy. Rod bearings may be alined before they are placed on the automobile

In the work of excavating for building operations, the tractor is fast coming into extensive use. Here two tractors are shown dragging scoop shovels, which dig up huge amounts of dirt and carry it away

In the new hydrometer shown above the measuring float is prevented from sticking to the side of the tube by two celluloid rings with studded points, thus insuring an accurate reading

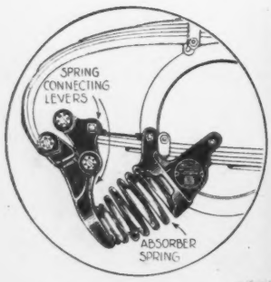


An adjustable chute for dumping gravel or sand fits in the side of the end gate; when a sliding door in the gate is open, the material flows through the chute to the side of the road

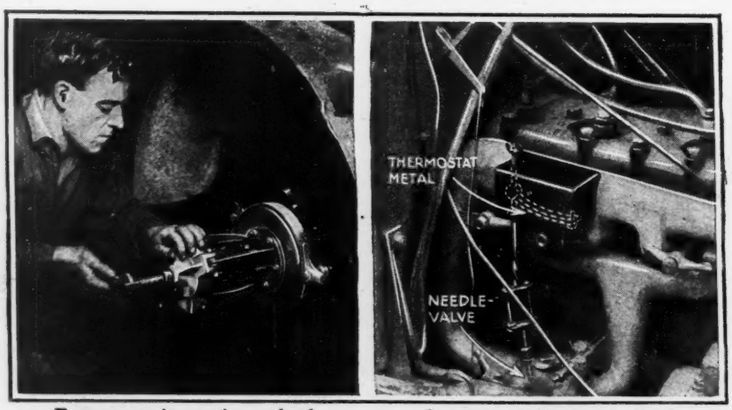


The problem of carrying a spare giant pneumatic tire on one- and two-ton trucks is solved in the instance shown above by placing it between the driver's cab and the front end of the tank

With this oil petcock opener, which is very easily installed, you merely need turn a handle by the running-board to learn how much oil you have. The device is rattle-proof

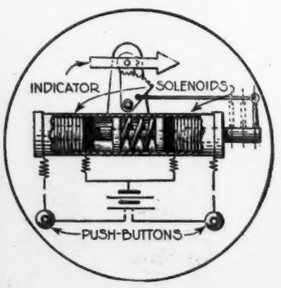


This shock-absorber does not require the changing of any part of the spring or axle construction; it is also said to add to the smart appearance of the car—besides which, of course, it it is an excellent shock absorber



For removing wire wheel-hubs and brake-drums from automobiles, this automatic grip-puller was invented; it requires only one man to operate it instead of the two formerly necessary; it comes equipped with two sets of pulling jaws

A new gasoline meter operates on the principle embodied in thermostatic metal: it allows of a rich mixture of gasoline in starting, but after the engine has operated for a period it automatically turns the needle-valve down to a lean mixture



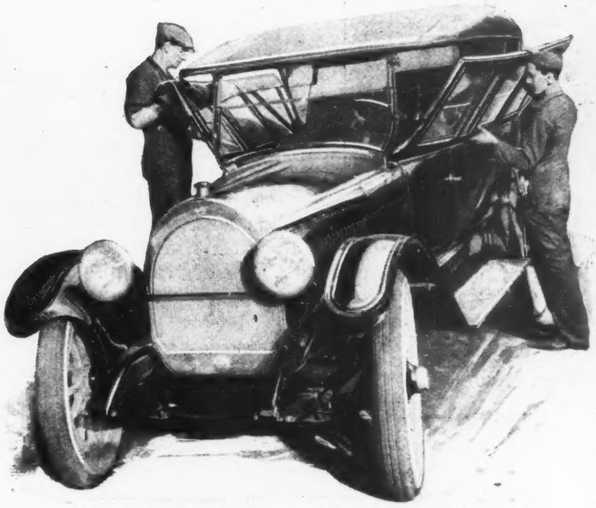
This is a diagram of an electrically operated indicator to show the driver behind you which way you are going. The indicator is placed on the license-plate, and is operated by push-buttons on the dashboard

When You Want Expert Advice About Your Car

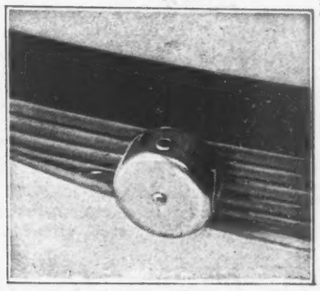
IN these pages of ideas about automobiles and motor-trucks the Popular Science Monthly endeavors to help its readers solve problems of maintenance and repair. But there must be special cases that are not covered, and we invite you to write to the Automobile Editor and let him advise you.

If you wish to know more about the devices pictured here, or if you want to ask questions, write. Some answers are given on page 78.

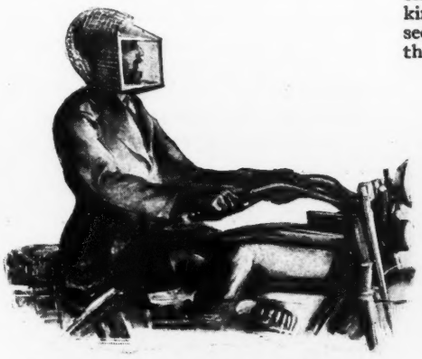
Install this spark-plug tester on your dashboard. Not only does it tell you whether your plugs are working properly, but it also intensifies the spark and increases the engine power. Valve-grinding and carbon-cleaning are also greatly reduced



Glass side pieces have at last been standardized; the ones shown above can be fitted to forty different kinds of touring-cars, thus turning them into sedans. The glass panels above the doors open with the doors



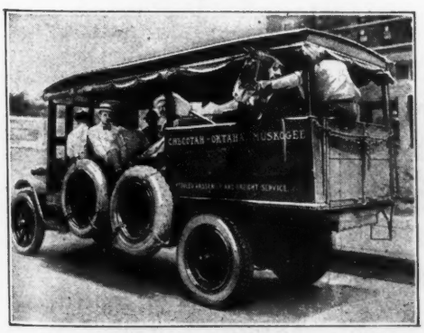
Let this small tank oil your springs for you; attach it to the edge of the leaves at some convenient spot and fill it with oil. A piece of felt fits between the edge of the leaves and the oil-tank; it allows the oil to seep through evenly



To protect his face from windburn this motorcyclist made himself a mask. The front of it consists of two celluloid sections joined in streamline formation. The head part is of wire netting

Here is a signaling system that should reduce accidents. Three handles control three disks. One has "stop" printed on it; another has an arrow pointing to the left; the third bears an arrow pointing to the right

A tractor is not an easy-riding vehicle; hence we now have an air-spring seat. It has an inner tube—like an automobile tire—that is filled with air; the tube absorbs most of the shocks



This motor-truck is built to haul almost anything. The front part has seats for passengers; the middle section carries merchandise; the rear is reserved for animals. Here you see a race-horse en route

Carbon that gets into piston grooves is hard to remove. Now, however, there is a tool for doing it. You place the curved section around the groove, grasp the handles, and move them back and forth

No longer need the peanut and popcorn man push his stand through the streets. He may attach it to his flivver in the manner shown above. On Sundays, however, he leaves the stand at home

With a truck only seventeen feet long, this is how a contractor managed to carry steel girders more than twice that length

It Carries Forty-Foot Girders

SOME people would think it an impossible task for a motor-truck with a seventeen-foot body to carry forty-foot steel girders. Yet this was done with the truck illustrated.

The owner of the truck built a separate steel framework over the top of the cab and braced it to a horizontal crosswise angle-iron, riveted to the front end of the truck-frame.

The steel framework that is built around the cab permits long girders to be carried by resting them in an inclined position, supported by the end of the body platform, the front end extending over the cab.

The body is made two feet wider than the cab and the front end is left open.

Revolutionizing the Engine

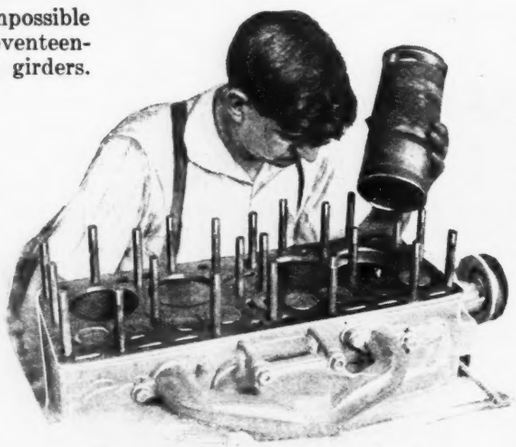
A WELL known company has introduced a motor-truck engine with several features of design that bid fair to become popular, also a revolutionary transmission design by which both speed and pulling power are increased.

The new transmission provides speed in direct drive as well as pulling power in the lower gears that does not necessitate an engine of excessive size.

The increase in speed is obtained by a more highly geared rear axle. The extra pulling power is furnished by giving the countershaft of the transmission an extra gear reduction.

The transmission countershaft has two sets of constant mesh-gears of different ratios instead of one. These are controlled by an extra lever, giving the truck two extra power ranges, each with a three-speed forward and a reverse direct drive remaining the same.

Approximately 50 per cent more speed, in direct drive, has been added by this two-range transmission, and 30 per cent more pulling power furnished through the low range of transmission.



Removing one of the cast-iron sleeves that form the cylinder walls. This is but one of the features of the new engine

Removable cylinder walls of the "wet" type are a feature of the new engine. These are in the form of cast-iron sleeves that are pressed into the cylinder block. Better cooling is assured, since the water circulates immediately around the walls. There is also the economy of replacement. Replacing the sleeve is here a simple matter, done without removing the engine.

The valve-lifters and rollers are in a case. Access to this is through a hand plate beside the engine. When the assembly is removed, access to the crank is had without removing the oil-pan.

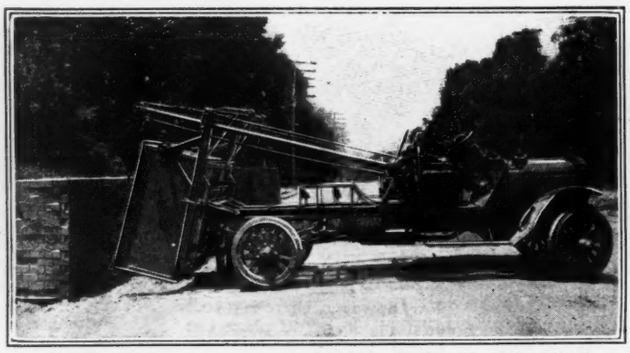
In the cooling system the engine has a pump and thermo-siphon action, the pump being mounted high on the engine so that the water is thrown directly around the firing-chamber.

Bricks Dumped in Stacks

USUALLY, when a load of bricks is dumped, you can hear the rumble for blocks. Some of the bricks are broken, and the remainder must be collected and stacked up. All this annoyance is avoided when the truck shown below is used.

The body of this truck, filled with stacked bricks, is lowered to the ground by means of a cradle that moves back and forth on the frame. This cradle operates in such a way that the demountable body travels in a curve and lands on the ground in a vertical position, all bricks intact. The side of the body that now becomes the bottom is held in place by two iron pipes. When these are removed, the bottom is released; thus, when the truck pulls away, it leaves behind an oblong pile of bricks, resting on the bottom. The three-sided body was then swung back into place and a new fourth side substituted for the one left behind.

The power is derived from the engine of the truck itself. And the driver operates it from his regular driving seat.



The body is swung over until it lands on its side. The side is released and left behind with the load of bricks

Does the Spark-Lever Mean Anything to You?

IN ordinary driving the position of the spark-lever need not be changed except for unusual road conditions after it is once set to run through a considerable range of speed. This condition is best found through adjusting and experimenting with the range adapted to each type of car.

The "knock" from an engine laboring uphill is due to the fact that the spark occurs on the compression stroke, and the explosion meeting the piston coming down, tries to force it, thus producing a sharp metallic thump.

One of the best ways to learn the proper use of the spark-lever is to drive at a steady speed, no matter what the road conditions, continually watching the speedometer to see that it maintains a consistent speed.

Tools for Truck Repairs

A dollar in time for maintenance saves many for repairs

By Joseph Brinker

"A WORKMAN is known by his tools," runs the old adage. Specially important are the tools used to repair the highly specialized machinery of a motor-truck.

In this article—the fifth in the Popular Science Monthly's motor-truck series—Mr. Brinker takes up the proper equipment for keeping an up-to-date motor-fleet in condition, going into detail about the right tool for repairing each part, and showing how the installation of such an outfit reduces the labor turnover.

This little device, called a wheel-puller, will remove the most obstinate gear from its shaft

FOR every three dollars spent on a motor-truck, one dollar goes for maintenance. The lack of one dollar spent on maintenance at the proper time may mean an unexpected break-down on the road and a loss of from ten to twenty-five dollars in operating income or the expenditure of an equal amount to get a second truck to complete the work of the first. Thus repair costs exert an important influence on total delivery costs. Truck-owners have learned that the truck is an expensive and complicated piece of mechanism that can be taken care of only by adequate repair equipment.

Adequate repair equipment may be divided under the two main heads of machinery and tools. Machinery is generally considered as apparatus permanently fixed to the shop floor, such as drill-presses, lathes, grinders; tools are the more or less portable objects, such as electric drills, special wrenches, and fixtures.

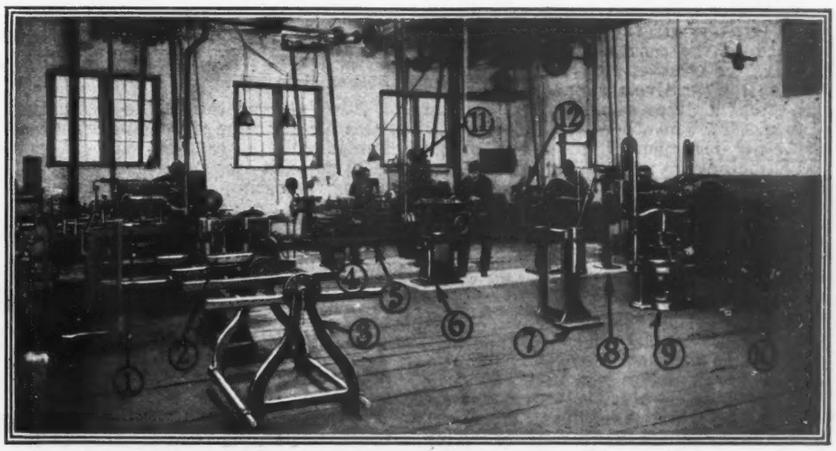
The amount of machinery and tools required to maintain motor-trucks depends to some extent on the number of different types and sizes of trucks used. It is impossible to give a set rule that so many trucks require such and such equipment, although there are certain fundamentals in the selection of equipment that cannot be ignored.

Unless a concern owns five or ten trucks, it is possible that maintenance repairs can be done more cheaply by an outside company or service station. But, once a company makes its decision to carry on its own truck-repair work, it should be entered into wholeheartedly. Halfway methods and quibbling about the cost of installation are bound to result in dissatisfaction.

The equipment for a small repair-shop sufficient to maintain from five to ten or more trucks should include a lathe; a drill-press; a grinder; a forge; an anvil; a welding table and welding apparatus; an air-compressor outfit; a large arbor press; an overhead crane or track with hoists and carrier; a cleaning-tank for parts; one or more engine stands; an axle stand; perhaps an engine burning and running-in machine with fittings and tool equipment consisting of a valve-lathe; a connecting-rod jig; a piston-vise; a crankshaft straightener; a bench arbor press, and miscellaneous hand tools, wrenches, etc.

Here is another device that will save the time and temper of the high-priced automobile mechanic

The work that can be performed by such machinery and tools is fairly well understood. A lathe is practically essential. It may be used to produce odd pieces that cannot be ordered from stock, such as bearing bushings or bolts with unusual diameters or threads. A drill-press is a most convenient piece of apparatus, for by it practically all sizes of holes may be drilled. Engine stands with adjustable frameworks permit the entire engine blocks to be turned around at will. A cleaning-tank, for removing dirt, grit, or even paint from parts on which work must be done, is another time- and labor-saver. Axle stands, arbor presses, and welding apparatus all have their place. A heavy truck axle is

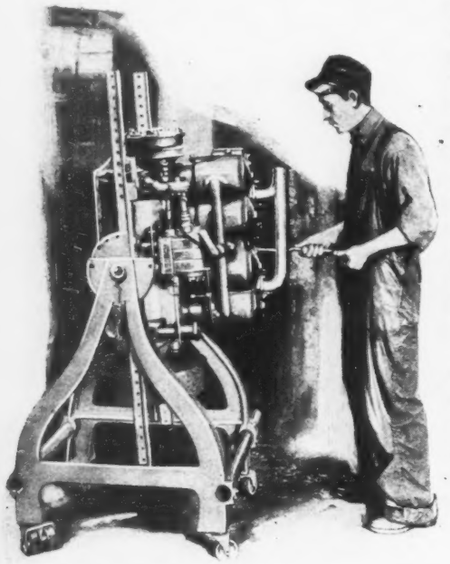


A Typical Up-to-Date Automobile-Repair Shop

1, engine-testing stand
2, 3 engine stands
4, lathe
5, turret lathe
6, oil-grooving machine
7, small arbor press
8, small drill-press
9, large arbor press
10, trunk box
11, large drill-press
12, acetylene-welding outfit

a most unwieldy thing to handle, unless it can be held rigidly in place and a definite system followed in disassembly and repair. Arbor presses can be used to straighten bent shafts and for other work. Special socket wrenches for getting at bolt-nuts in inaccessible positions save much time and temper.

Small gear-pullers come in handy when gears are obstinately stuck on their shafts. Piston-inserting devices, spark-plug testers, battery testers, and the like are all handy tools that help to cut down the total cost of doing jobs.



With an engine-stand the repairman can turn the whole engine to any position that it is convenient for him to work on

As the size of a truck fleet increases, truck maintenance becomes more and more of a science in which accuracy must supersede guesswork and speed must replace slowness. In making small individual savings, the yearly savings may surprise the truck-owner. It is impossible to secure speed and accuracy by haphazard methods. Granting that some mechanics are more skilled with their hands than others, the use of adequate machinery and tools makes it possible for the skilled worker to increase his output without affecting its quality.

With adequate equipment the average mechanic can do far better work. He cannot do his best work when he lives in constant fear of being discharged; for seeing men coming and going has a psychological effect that tends to disconcert a mechanic's efforts.

Then there is other equipment, neither machinery nor tools, which has a direct bearing on maintenance costs. Portable gasoline-tanks permit the fuel to be carried to the trucks. Savings in time and money may be made by an adequate oil-storage system. One truck-owner, using approximately one hundred dollars' worth of oil a week, saved $260 a year in oil by the introduction of permanent tanks with convenient draw-off plugs and drains.

Special cleaning-tanks, in which cleaning compounds and hot water or steam are used, cleanse truck parts of dirt and grease quickly, cheaply, and thoroughly

Write to Us About Your Motor Troubles

The Popular Science Monthly invites you to send your automobile problems to the Automobile Editor. He can tell you anything you want to know about a car, and he is here to help you

Determining Battery Poles

Q.—Can a voltmeter be used to determine the negative and positive poles of a battery and if so, how?—J. B. B., Chicago, Ill.

A.—A voltmeter can be employed to determine battery poles by touching the voltmeter poles instantaneously across the circuit. If the needle moves upward in the normal direction on the scale, the other end of the wire leading from the positive terminal of the voltmeter identifies the positive battery terminal. The other terminal must be the negative one. If the needle of the voltmeter does not register, it indicates that the connections must be reversed.

Advantages of Four Valves

Q.—Please explain why automobile engines with four valves to the cylinder instead of two give more power.—J. H., New York City.

A.—The total power that can be developed by a gasoline engine depends upon the amount of gas it can burn. When four valves are used for each cylinder, it is possible to get the incoming fuel and the burnt gases out of the cylinders more quickly. This also results in a smaller admixture of dead or burned gases with the incoming fuel so that the explosive power of any given amount of fuel is increased. The quick intake and discharge of the gases from the cylinders also permit of greater power through an increase in engine speed.

Re-Using Lubricating Oil

Q.—Can the lubricating oil used in automobile-engine cylinders be re-used for other purposes on the car, and if so, must it be strained or otherwise treated?—S. W. B., Boston, Mass.

A.—Provided the engine lubricating oil is drained from the engine crankcase immediately after the car has run 1000 miles, it may be re-used for lubricating the spring-bolts and connections or even in the gearset if it is strained and was a good oil in the beginning. When used for gearset lubricant, it should be mixed with grease until of the consistency of a non-fluid oil.

Soapstone in Tire Casings

Q.—What is the purpose of powdered soapstone when sprinkled inside a tire casing?—A. B., Easton, Pa.

A.—Soapstone acts as a lubricant to prevent the tube from sticking to the casing when heated up and to prevent friction between the tube and the casing, the principal cause of rapid tube wear. Soapstone should be renewed once or twice a year. Great care should be exercised in sprinkling the soapstone inside the casing in order that it is spread evenly and not in spots where it will heat up and burn the rubber of the tube.

To-Day's Gasoline

Q.—What does the gasoline used for cars test per day? Can gasoline fuel be compressed and exploded without electrical ignition? If gasoline can be compressed to ignite of itself, to what pressure must the fuel be compressed?—F. S. P., Durham, N. H.

A.—About 54° B. Yes. About 500 lbs. pressure per sq. in. to insure continuous operation of the engine under the most adverse conditions.

Delivery Costs and Sales

Q.—Please supply us with figures relating to the ratio that cost of delivery should bear to total gross sales.—E. & B. Mfg. Co., Selma, Ala.

A.—According to the Federal Census Bureau, 1916, the percentage of delivery costs to gross sales are as given below:

Business	*Per Cent*	*Business*	*Per Cent*
Ice	45.6	Breweries	9.2
Soft Drinks	20.2	Lumber	6.8
Brick	19.9	Groceries and Meat	4.4
Bakeries	19.8	Hardware	3.0
Laundries	15.3	Furniture and carpets	2.8
Coal and wood	15.2	Department-stores	1.5
Ice-cream	14.9	Wholesale meats	1.1
Dairy Products	12.1		

A Priming-Cup for the Intake Manifold

By Robert A. Chandler

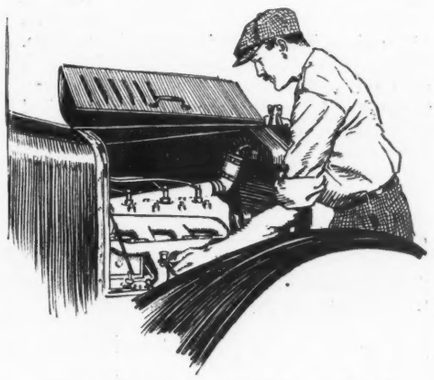
A RIGHT-ANGLED priming-cup set at the fork of the intake manifold on the Ford engine will be found to be one of the most useful fittings on the car. It is seriously needed on the Ford, but may be used on many other engines to advantage. If a dash control is added, as shown, its utility is very much increased.

The thread is the standard ⅛-in. pipe for which a 5/16-in. drill should be used. These may be obtained in any hardware store or machine-shop. Buy a priming-cup with a flat handle so that a hole may be drilled in it for the rod from the dash. This rod should be bent at right angles and kept from falling out by a split pin.

The greatest utility of this fitment is in removing carbon. Water is poured in slowly while the engine is running. The gas lever will have to be advanced slightly, the distance being found by trial. Water admitted by this means turns to steam, blowing the carbon out with the exhaust. If the car is equipped with a muffler cutout, tie this open so that the water and carbon will not accumulate in the muffler. Place a piece of newspaper below the cutout, and you will marvel at the amount of carbon removed.

Some use peroxide of hydrogen, on the theory that the extra oxygen combines with the soot, burning to carbon monoxide or dioxide and so assisting the process. A quart of this liquid run through the engine is certainly less expensive than removing the head and scraping by hand, besides taking much less time. On account of its convenience it may be done frequently, whereas if the carbon must be removed by hand, there is a tendency to put off the process of scraping until the cylinders are badly choked. Alcohol is favored by other drivers and is to be used in the same way. Use the denatured, as it is cheaper than the wood alcohol.

On no account use kerosene for this purpose. Some misguided drivers use it and point to the heavy smoke issuing from the exhaust as evidence of carbon being removed. But this smoke will be produced from a perfectly clean engine, as it is merely unburned kerosene. Consider a minute. Your carburetor is still feeding a mixture of gasoline to the engine that is very nearly correct. If kerosene is added, there is not enough oxygen left to absorb or burn all of



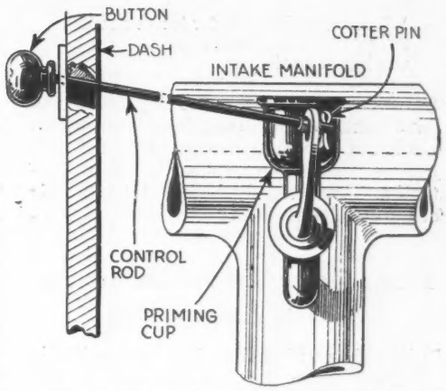
If your intake manifold is equipped with a priming-cup as shown here, cleaning out the carbon in the cylinders is greatly facilitated

it, so it is charred, making a heavy smoke of unconsumed carbon.

But some engines suffer from an incrusted layer of carbon that cannot be removed except by scraping. Here again the priming-cup will be of temporary use, for it may serve to diminish the knock. It will not remove the scale, but when the knock develops, a few cupfuls of water will quench the fire and wet the carbon enough to keep it quiet for some time. This enables you to put off the process of scraping until some more convenient opportunity.

Another use for this fitting is to assist in starting the engine, especially in winter or even on a cool morning in summer. Gasoline may be fed while the engine is cranked. The Ford carburetor has a pool of gasoline especially made for aiding in starting, and the choke valve controlled by the wire through the radiator undoubtedly assists, but what is needed is a spray of gasoline that will evaporate quickly. As a liquid running down the side of the manifold gives a greater surface than the pool, much better carburetion results. If the valve of the priming-cup is only opened part way, so as to allow the gasoline to enter slowly, and the engine is cranked at the same time, atmospheric pressure will force it in as a spray, making evaporation much more certain.

Finally our device may be used to give a little more air to the mixture and so develop more power with greater economy of gasoline. The only adjustment to the Ford carburetor is on the spray nozzle, the air-valve being entirely automatic and not subject to control. The driver changes the adjustment of the spray nozzle from time to time until he finds the best position for



The detail of the attachment of the priming-cup is here illustrated, also the method of controlling the valve from the dashboard

level roads, and then he opens the valve about a quarter turn for hill-climbing. By experimenting with the priming-cup as an auxiliary air-valve, giving more gasoline from the spray nozzle, and changing the air to fit, he will occasionally find a marked improvement.

Sun- and Rain-Shield for the Automobile

THE owner of a Ford sedan recently made and attached to the frame about the upper section of the wind-shield of his car a simple sun- and rain-shield, the details of which are shown in the illustration.

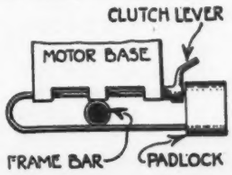
This homemade accessory will keep sun and rain from the face of the driver, increasing the margin of safety

The frame consisted of a length of ¼-in. brass rod with four bends, a width of rubberized fabric, such as is used for top covering, sewed about the frame, and the rear edge seamed. This improvised awning was secured by means of four small bent clips with screws to the wood framing.

The attachment was made for several purposes—as a protection from rain blurring the upper glass of the wind-shield, to shut off the direct glare of the sun from the eyes of the driver, and to overcome the confusing glare of the overhead street lights when driving at night.—G. A. Luers.

An Emergency Repair of a Clutch-Pedal Stud

I WAS traveling on my motorcycle through the desert regions of the West when I had a fall that broke the clutch-pedal stud of my machine. At first it seemed a hopeless problem, but I solved it by using a long-shanked anti-theft padlock.



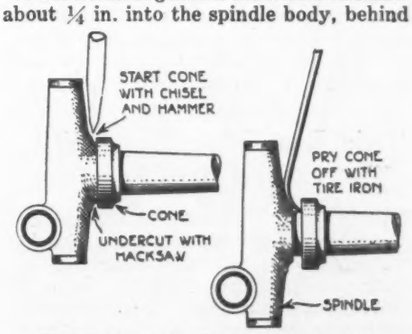
How the padlock shank was used

The picture clearly illustrates how the shank was passed through the motor base and the clutch lever, holding it in place after the lock had been snapped.

Removing the Ford Wheel Spindle Cone

WHEN the inside cone of the Ford or any other smaller spindle becomes worn, it is often difficult to remove it from its seat.

First a slanting slot is cut with a hacksaw about ¼ in. into the spindle body, behind



With a blunt chisel and a tire iron the wheel-spindle cone may be removed

the hardened cone, then a chisel is used as a wedge between spindle and cone until the cone becomes loose enough to be removed with two tire irons used as pinch bars.

A Hinged Support for the Coffee-Mill

A COFFEE-MILL permanently attached to the kitchen wall is apt to be in the way and is also a dust-catcher.

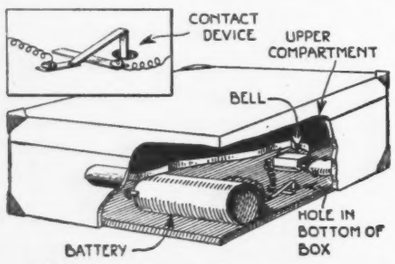
An easily made wooden angle-bracket hinged to the edge of a cupboard-door

When the coffee-grinder is not needed, it can be swung out of the way under the kitchen cabinet

frame permits in its outward position the easy operation of the mill, and when not in use it can be swung into an out-of-the-way position inside the cupboard. The illustration shows clearly how the support is constructed.—EVERETT ROGERS.

Keep Your Valuables in an Alarm Safety Box

THIS box will cause a bell to ring if it is lifted from its resting-place. The bottom compartment contains a contact device, electrical bell, and battery. The



Lifting the treasure-box turns on an electric alarm concealed in the box

top compartment is used for the valuables. The details of the spring-contact device are shown in the illustration.

When the box is resting on a table, the spring-contact device will be held up. When the box is lifted, it will go down, making contact, and ringing the alarm bell. A lock should be placed on the box.—GEORGE BENNER.

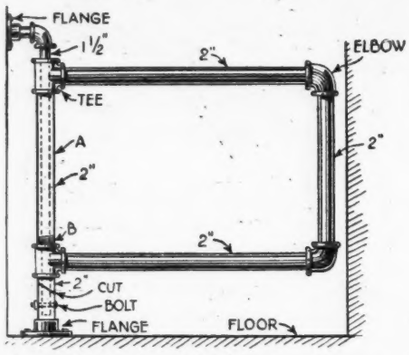
This Iron-Pipe Gate Will Close Itself

DESCRIBED here is a gate that can be made from odd pipe parts that would ordinarily go to waste, but even if it is necessary to purchase the parts, the cost will be slight and a neat and efficient self-closing gate will result. It is especially suitable for entrances in offices, machine-shops, and garages.

It is made of 5 pieces of 2-in. pipe of suitable length, two 2-in. elbows, and two 2-in. tees, one 2-in. floor flange, one 1½-in. floor flange, one 1½-in. elbow, a 1½-in. long nipple, and a 1½-in. pipe of the proper length.

The gate part is made up first. The lower end, *B*, of the hinge-pipe, *A*, has an extra long thread and is screwed in as far as possible and then unscrewed into the upper tee where there is a very short thread. About three turns should make this tight. This leaves the lower end somewhat loose but not noticeably.

The short piece is cut on an angle of about 30 degrees and one part is screwed into the lower end of the gate tee. The other piece is screwed into the floor flange. The 1½-in. pipe is passed down into this pipe and fastened with a small bolt passed through. Slip the gate over the vertical pipe, place the elbow, nipple, and other floor flange, and screw into place on the wall or door frame. Smooth the bearing

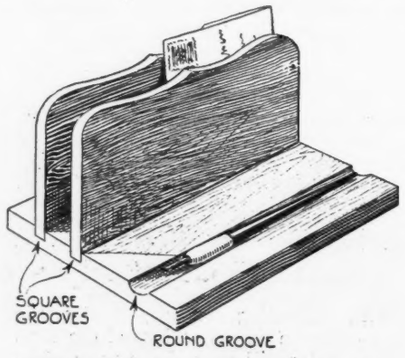


This gate, when released after having been opened, will close by its own gravity

surfaces of the gate and the support with a file so that they will work easily, allowing the gate to drop and swing into the closed position when not in use.

A Homemade Holder for Pens and Letters

MATERIALS for making this holder are a piece of wood for the base and two more pieces for the letter-holder. One groove is made about 1 in. from the edge of the base, as shown in the illustration. This groove is rounded, so as to hold pens and pencils. Two more grooves, square at the

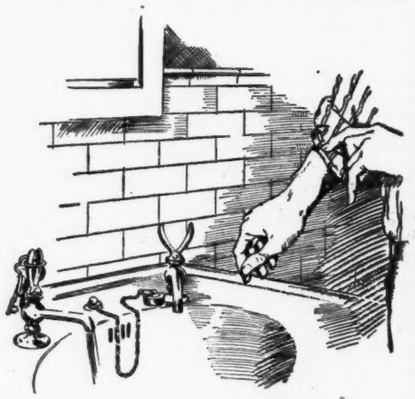


This holder is very useful and, if neatly finished, will be an ornament for your writing-desk

bottom, are made in the middle of the base, to hold two upright pieces of wood, between which letters and papers are put. The picture shows where they are placed. Shape the two boards to act as the letter-holder to suit your taste and glue or screw them in the two grooves meant for them. Sandpaper the wood and give it a coat of shellac or varnish.—ARTHUR GOLDENBAUM.

Hold the Faucet Open with a Key-Ring

FAUCETS of the type shown in the accompanying illustration are employed very often in hotels, clubs, lavatories, restaurants, etc. In this type the inconvenience of having to employ one



Did you ever think of using your key-ring for holding the faucet of the wash-stand open? Try it!

hand to maintain a flow of water is apparent.

The illustration shows a method of avoiding this handicap by a simple expedient, a key-ring, which practically every man carries. Just slip the ring, keys and all, over the widest part of the handle. Your water supply is constant and both hands are free.—ANTHONY E. ZIPPRICH.

How to Keep the Pen with the Ink-Bottle

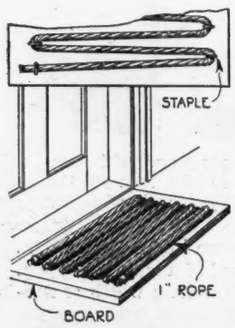
OFTEN the household pen becomes separated from the household ink-bottle. The little device shown here will keep the pen where it belongs.

Attach the pen to the ink-bottle

A piece of fairly heavy wire is wound around the neck of the ink-bottle. The surplus wire is then bent into a hook that has spring enough to hold the pen. When you have finished writing, the pen is placed in the hook, where it will remain until again needed.—CARL ROYER.

Old Rope Can Be Used for a Doormat

ROPE fastened to a board with staples can easily be made into a very serviceable doormat. A staple is placed at one end of the rope. The rope is then run across the board and another staple placed. This operation is repeated until all the available space on the board is used up.



Old rope makes an excellent doormat

About 20 ft. of 1-in. rope make a very good doormat. The spacing should be about 1½ in. between ropes.—L. LAURIER.

Constructing a Table for Photographers

By Ernest Barton

AN amateur photographer's greatest help is a table suitable for all kinds of photographic work. It consists of two lateral frames between which the table proper can be inclined at any reasonable angle to facilitate the work. It also carries two sliding tops that enable the photographer to take macrophotos by simply introducing bellow extensions. With this apparatus life-sized pictures of small animals or objects can also be secured.

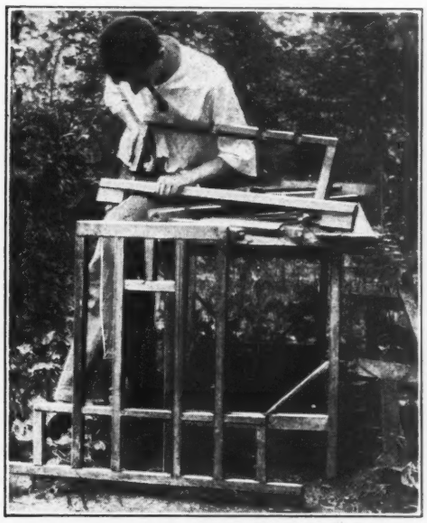
The first important step in the construction of the table is the frame. This consists of two equal lateral sides whose dimension and shape can be seen. The parts are made from 1 in. by 1 in. pieces of cypress, since this is both light and strong. The top frame is made of a wider piece of wood, ¾ in. by 1¾ in. The center of this piece receives a hole ¾ in. in diameter. This is the pivot and allows the table to be inclined at any reasonable angle.

When the two frames have been assembled, glue them together and allow them to dry. Six cross pieces are made from 1 in. by 1 in. wood, 12 in. long. and provided with dowels. These are attached to the frame as shown in the illustration.

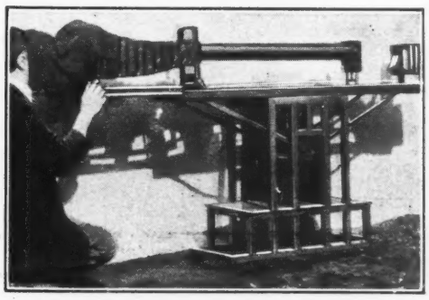
To make the sliding table, two pieces of wood ¾ in. by 1¾ in. and 4 ft. long are taken for the sides. Clamp these down upon the table so that they are rigid, and begin to cut two grooves at least ⅜ in. in depth. If you have no plane for this kind of work, take a chisel ¼ in. in width, bore a slanting hole through a piece of wood, provide a slide on one side, and place the chisel in this hole. This is a simple but very effective plane for cutting grooves. When both pieces of wood have been grooved and each piece has received two grooves at equal distance from each other, each piece is screwed to a 1 in. by 1 in. strip, 1 ft. in length. The exact center of each of these pieces is provided with a hole ¾ in. in diameter.

The pivot consists of a 1 in. by 1 in. strip, 15 in. long; with the exception of 8½ in. from the center, the strip is rounded off so that it will fit snugly through the holes provided. Pass this pivot through the table holes, and attach a board to the two 1 in. by 1 in. in which the holes were made. Also fasten the center of this pivot to the board so that it is immovable. At one end of the table-top attach a 1 in. by 1 in. so that the upper part of the groove is plugged, and at the other end attach another so that the lower groove is stopped up. These strips will prevent the sliding table from sliding in the wrong direction and will also hold the grooved top firmly together.

Here the table is tilted for greater convenience in focusing for the life-size photograph of a plant



After all parts have been cut and adjusted, it is easy to join them together to form a rigid structure



For taking greatly enlarged photographs of minute objects an extension consisting of a paper tube is used

Place the table-top into the holes of the frame, and place the cross pieces in place, but without permanently fastening them in place. See to it that all parts fit snugly together and that the table can be easily inclined. Then attach two large angle-irons to the board, turn the lower end so that it will face the sides of the frame, and, after finding the arc the angle-iron describes, place the piece of wood to the frame as shown. This keeps the table-top rigid in any position with the aid of winged screws.

The sliding frames are now made. These consist of 1 in. by 1 in., having narrow strips attached that fit easily into the grooves of the frame so that it slides smoothly. The tops of the frames receive boards at intervals, which keep them rigid and firmly pressed into the grooves. The upper frame slides to the right, the lower to the left.

When all these parts have been assembled, the cross pieces as well as any other loose pieces can be glued and fixed in place. The table-top can be further strengthened by attaching two braces running from the end of the table to the lower part of the angle-irons.

It is desirable to provide a few shelves on the table, not only for convenience, but also for strength. Their place of attachment can easily be seen from the illustration.

After staining or painting the table, it only requires the camera. This should be a double-extension bellows camera, and it is to be firmly fastened to the upper movable table. For larger extensions, large diameter paper tubes or square tubes made from cigar-box wood are easily constructed. These should be so made that one box fits snugly into another, and so that any number of them can be used according to the magnification desired.

An important detail is to see that each extension finds a support upon the table. This prevents sag and breakage of the different extensions. The greater the magnification, the better the lens should be. Excellent photos can be taken with a double anastigmat lens of wide aperture. And even here it is not recommended to make enlargements more than ten times. For higher magnifications use a microscope that can easily be attached to this table. Without any extra bellows extension photos can be taken in their natural size.

Focusing in any of these cases is done as usual upon the ground glass. To obtain especially sharp negatives, remove the ground glass, and, taking a hand lens and holding it in the plane of the removed ground glass, focus with its aid.

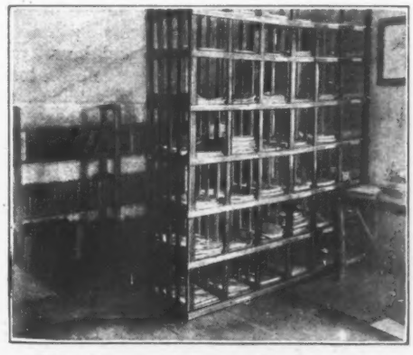
To Keep Your Magazines in Order

PICTURED here is a magazine-rack with forty-two separate compartments. In the case of small magazines, two may be located in one compartment, hence the rack will take care of fifty or more stacks of papers, booklets, magazines, etc.

It is most inexpensive to build when constructed of the lattice material shown. The corners and middle supports are 2 in. by 1 in. material; 400 ft. of the lattice material was required and 10 ft. of the 2 in. by 1 in.

The frame for the rack was first built. It was 18 in. wide, 6 ft. long, and 7 ft. high. It was not secured to the floor and was placed 3 ft. from the nearest wall along its side so that it may be approached from either side.

After the frame was made it was simple enough to cut and nail the lattice sticks in place as shown. Small wire brads, made purposely for tacking together light lumber, were used in building the rack upon the frame. The completed rack was filled and stained light oak. Each compartment has across its top the name of the magazine, catalogue, or paper that it contains.



This homemade magazine-rack will hold many magazines or pamphlets and is easily accessible for cleaning

Coil-Winding Suggestions for the Amateur

By H. H. Parker

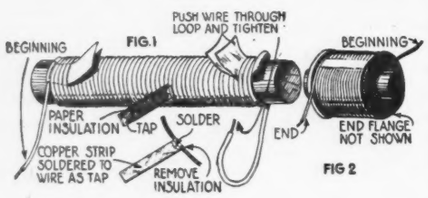
WINDING a coil of insulated wire for an electromagnet, dynamo field, or transformer becomes an easy operation if the amateur follows the directions given below:

In Fig. 1 is shown a coil wound upon a round core. To simplify matters, a single layer of wire is shown, but the same principles would apply to a coil of any number of layers. To secure the beginning, or first turn, of the coil, a short length of tape, or tough paper, if fine wire is used, is doubled over the beginning of the first turn and the succeeding turns wound over the two layers of tape.

After winding on four or more turns, the tape ends are brought out and the winding continued. Then if there is any looseness at the end of the wire, this may be taken up by pulling on the ends of the tape. The last turn of the coil is secured in a similar manner; a length of tape is doubled and laid on the core before winding the last four or five turns, these being wound over the tape, leaving a loop at the outer end through which the end of the wire is threaded at the last turn. Then the loop is pulled tight and both ends of the coil are held in place.

Sometimes it is desired to connect less than the whole number of turns of the coil into the circuit, as in the case of a transformer or reactance coil. Then attach extra terminal wires, or "taps," at the points covering the required number of turns.

The simplest way to make a tap is to solder a strip of copper to the wire, before winding it in place, by removing the insulation from a space equal to the width of the strip, bending this around the wire and soldering. The strip is then insulated by wrapping with oiled paper or empire cloth and it may either be brought out through the coil at right angles to the core, between the subsequent layers, or laid flat and



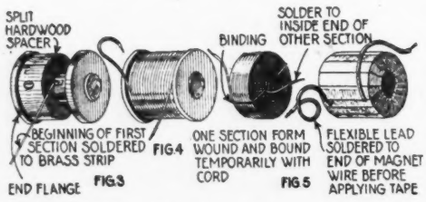
How to begin the winding of a wire coil around a cylindrical core and how to fasten the end coils

brought out through the end of the coil, between two adjacent layers and parallel to the core.

The next point to be taken up will be the disposal of the troublesome inside end of the coil and the best way will be to do away with it altogether and have both terminals on the outside of the coil. This can be accomplished by winding the coil in two sections, as in Figs. 3 and 4. First a short strip of brass or copper is cemented to the core insulation midpoint of the winding space and the inside ends of both sections will be soldered to this strip.

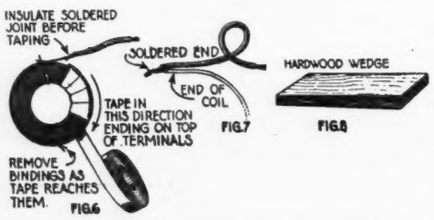
A spacing block is made to clamp over half of the winding space while one section is wound, first soldering the end to the strip and insulating it from the first layer with paper or tape. If the section is evenly and tightly wound, it will remain in place after the spacing collar is removed.

The beginning of the second section is


SPLIT HARDWOOD SPACER
SOLDER TO INSIDE END OF OTHER SECTION
BINDING
BEGINNING OF FIRST SECTION SOLDERED TO BRASS STRIP
FIG.4
ONE SECTION FORM WOUND AND BOUND TEMPORARILY WITH CORD
FLEXIBLE LEAD SOLDERED TO END OF MAGNET WIRE BEFORE APPLYING TAPE
END FLANGE
FIG.3
FIG 5

Winding a coil in two sections is here illustrated. The sections should be wound in opposite directions

now soldered to the other end of the strip and the section wound in the opposite direction from the first. It is absolutely necessary to reverse the direction of winding, as otherwise the two sections will neutralize each other. If the winding is performed in the lathe and it has no reverse, the same result is attained by removing the coil and turning it end for end after completing the first section. As shown in Fig. 4, both ends of the completed coil will lie on the outside, and if one should break,

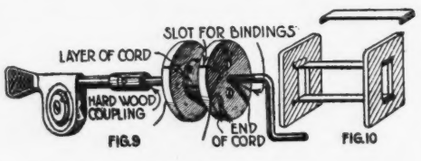


After the coil is completed, it should be wound with insulating tape, which will hold the coil firmly together

it will be unnecessary to re-wind the whole coil. Furthermore, there will be no inside terminal to lie across the end turns and both ends will lie away from the iron core.

A form wound coil may be constructed in the same way and taped after removal from the form, but a modification is shown in Fig. 5, where two form wound sections are made separately, both wound alike and in the same direction. Then one is turned end to end, the now adjoining *inside* terminals soldered together, the joint insulated and the two sections taped into one coil. Fig. 6 illustrates the proper way to apply the tape. First, terminals of lamp cord, or other flexible conductor, are soldered to the coil ends to serve as leads and prevent breakage. As it is usually preferable to have both terminals leave the coil in the same direction, one lead is reversed as shown. The tape is started under and away from the terminal connections, which should both be insulated after soldering, carried around the coil and ended over the leads and a little beyond the beginning of the wrappings.

Figure 8 shows how a completed form wound coil may be opened up slightly by means of a smooth greased wooden wedge. In Fig. 9 a speed indicator is attached to



For ascertaining the number of windings on the spool or core a speed indicator may be used

the end of the winding rig shaft (or to the lathe spindle) to keep track of the number of turns, something the coil winder himself will find it difficult to do. Should it be necessary to unwind a number of turns, the revolution counter will back up also, so that the correct count will not be interfered with. Before the winding is started, a layer of heavy cord is wound on the core of the form; the insulation, if used, is wound over this. When the coil is complete and the flange removed from the form, this cord layer is pulled off and the coil then easily removed. Slots are shown in the end flanges of the form through which bindings are placed to temporarily hold the coil together after removal.

Figure 10 shows how brass or iron strips are used to hold together the two end flanges of a coil that is wound directly on the core. If the core is round, three or four narrower strips are used.

The Camera Romantic for Home Use

THE camera romantic, as its name would imply, has no practical value, but is interesting and amusing, as with it you can get all kinds of effects.

To make one, get two small mirrors of the same size, about 3½ by 5½ in. Take off the backs or frames, and in the center of one scratch a ½-in. hole in the silvering.

Now make a little box with ends of the same size as the mirrors, and nearly twice as long, with no top to it. Cigar-box wood will answer the purpose. At one end

This toy, primarily intended for children, will also entertain grown-up persons

bore a hole so that it will exactly fit the hole in the silvering when the glasses are placed in the box at the ends.

Now make some scenery, such as little trees, houses, and such like, to stand at the sides of the box. Paint them on thin cardboard on both sides and cut them out so that one edge is the natural shape and the other straight, set them on pieces of wood and stand them against the inside of the box. Make little figures of persons and animals to stand about in the center; paint them on both sides. Now look through the hole and you will see not only the scene you have set up, but many others.

You can make various sets to go inside and have your figures move about by means of wires from holes through the sides or wires from the top.

Suggestions for Training Dwarfed Fruit-Trees

By E. Bade

DWARFED fruit-trees are always grafted on slow-growing root stocks. They should never be planted so low in the soil that they touch, or cover, the grafting scar. If they are planted too low, they will detach themselves from the root-stock, produce their own roots, and soon lose the entire appearance of a dwarfed fruit-tree. Then they produce many strong shoots, and flower much later than before. The grafting scar is always characterized by a peculiar thickening of the stem and is always found about ½ in. above the root-stock.

The best-developed fruit is always produced by the dwarfed trees. Where a common apple-tree produces ten apples, the dwarfed tree produces but one, but this one fruit is of the best quality and superior to ten apples of the common tree. For their size the tiny trees produce a greater quantity of fruit than the larger trees. In addition to this, these trees produce fruit in the second year after transplanting, and sometimes even after the first year.

There are two classes of dwarfed fruit-trees: those that are free standing, and those grown against walls or lattices.

One of the free-standing forms is the pyramid. It consists of a single vertical stem from which side arms are produced. They girdle the stem uniformly of their own accord.

It should always be observed, when pruning, that the branches are cut just above the buds, and that the buds are opposite to the main branch. The main branch should be so cut that a new series of branches can be formed, leaving the main stem vertical.

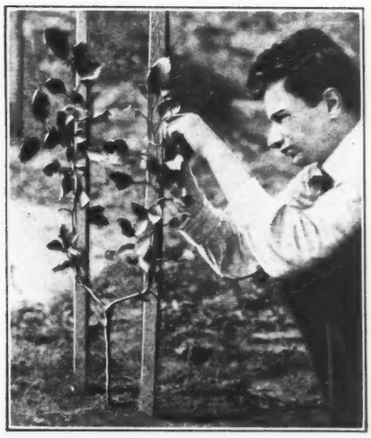
Trees That Cannot Be Forced

Fruits containing large stone pits can not be grown in pyramid form.

Dwarfed trees that are to be grown against walls or are to be forced into definite shapes, require permanent supports. The apple does not like to be placed against the wall; it develops better and more luxuriantly when it is placed in the open where it can receive light and air from all sides.

All latticed and formed fruit-trees are the result of constraint. All of our fruit-trees attempt and desire to grow upward,

One of the most attractive forms of training dwarfed fruit-trees is the free-standing double-U shown here



The beginnings of a simple U-shaped tree require much care and attention

How the young tree is trained to form a cordon along the stretched wire

away from the soil and toward the light. But in these dwarfed trees the upward growth is checked by the fruit-grower to make the trees conform to the desired shape. They are not meant for the orchard of the amateur who can not devote his entire time to the care and pruning of these trees. Only the simplest forms are recommended and the larger trees should not be chosen for training.

The three main forms of the trained fruit-trees are the cordon, the palmette, and the free standing form. All are developed from one-year-old grafted stocks that, through pruning, were forced to grow in the desired form.

The cordons are vertical or horizontal one- or two-armed trees. They have one main stem, about a foot above the ground, and one or two branches, which, when they are trained horizontally, are attached to wires strung at the right height. Those forms having two arms should have both at the same height. But this is not accomplished by pruning the one-year-old stock, since one branch will remain lower than the other and also be weaker. Both branches must be developed from the main trunk. If both branches should not be equally strong, then the stronger can be bent slightly downward in the spring and the weaker bent slightly upward. Since the sap prefers to rise as perpendicularly as possible, the weaker branch will soon become stronger, and when both are equally strong they can be replaced in the original position.

Cordons grown at an angle are usually placed against lattices. They are trained to grow at an angle of 45 degrees or less. The trees are planted two feet apart. The same is done with the double cordon, but in that case their branches cross each other.

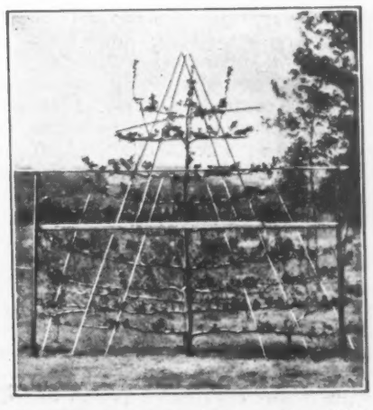
The simple vertical cordon is especially adapted for narrow high lattices and the pears are the best adapted for this form. They are easy to train and to keep in good condition.

Some of the Forms that Are Used

The U form and the candelabrum form are sometimes considered as a double or triple cordon, but are more correctly defined as a variety of the Verrier palmette. These forms have a number of branches arising from the main stem and running, one on each side, in opposite directions. The U form has only two branches which, after branching from the main trunk, are perpendicular. The candelabrum has a third branch arising from the main trunk, but this branch only too often escapes the hand of the pruner and does not bear any fruit. For this reason it can not be recommended.

A much better form is the Verrier palmette, which often covers an entire lattice. The distribution of the sap is one of its best features, and it is even and uniform in shape. It can be successfully used with any fruit-tree as its shape is most constant. But one should only plant Verrier palmettes with an even number of branches.

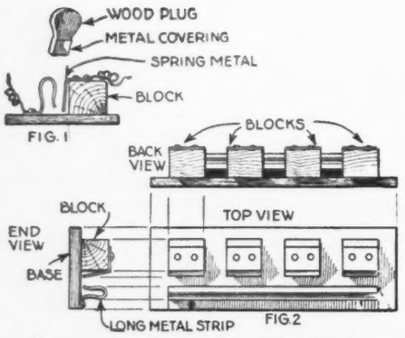
A well-formed Verrier palmette is the four-armed or double U-shaped tree. It is easy to keep uniform, the strength of the opposite arms are equal, and the fruiting branches are well distributed. These are also developed from one-year-old grafted stock cut back so that three buds can develop. The upper of these three buds lies forward; the other two must lie sidewise and opposite each other. These buds form the main stem and the two lateral branches. All other shoots that may develop are pruned and cut off. The shoots of the three buds are attached to a support. The center shoot is trained vertically, the two lateral branches are trained at an angle of about 45 degrees. Later, before they become too woody and hard, they are placed in a horizontal position.



In this picture is shown a beautiful example of a fruit-tree trained in pyramid form like a candelabrum

To Make Various Kinds of Electrical Switches

By L. A. Laurier



One of the simplest switches is the plug-switch, which is here shown singly and for four contacts

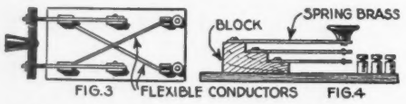
IT is the purpose of this article to outline the construction of a number of simple switches and connecting devices that will facilitate experimental work along electrical lines. Any one of the switches described can be put together with materials at hand.

A simple little jack or plug switch is shown in Fig. 1. It is necessary to have only a small base and a little block of wood and two pieces of springy metal, such as phosphor bronze, to construct this switch. The block is mounted at one side of the base and a piece of phosphor bronze bent at right angles is drilled out to receive two screws. This is screwed to the block as illustrated.

Another piece of phosphor bronze, bent in the form of a hook, is screwed to the base opposite the block as shown. This spring should be bent so that it will not touch the block. The little wooden plug is cut from a piece of soft pine and a metal piece is tacked over its end. Thus, when the plug is inserted between the two metal pieces of the switch, the circuit will be closed, and when the plug is removed, the circuit will be opened.

The switch in Fig. 2 is for use with four circuits. It will be seen that here four blocks are used similar to the single block used in the switch shown in Fig. 1. Instead of four individual contacts a long strip of metal may be placed to act as a contact for the four blocks.

A method of converting an ordinary double-pole double-throw switch into a reversing switch is shown in Fig. 3. Here



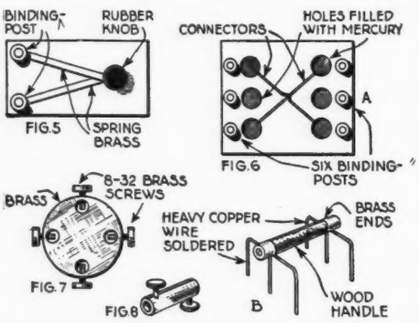
An ordinary double-pole double-throw switch can be converted into a reversing switch

two flexible contacts connect the four end points of the switch in the manner shown. The connecting wires should be insulated where they cross. This switch will find a number of uses in direct-current work where it is necessary to reverse the current to reverse the polarity or direction of a motor.

Another useful little switch is pictured in Fig. 4. First a base is squared up and sandpapered. Then a little wooden block with steps cut in it is mounted on the base. Three phosphor-bronze strips are then cut and drilled at each end. It will be seen that these strips are of different lengths to correspond with the steps cut in the block. One end of each of the strips is provided with a contact and the other end is screwed down to the corresponding step in the block. The top piece has an insulated knob at its top. Three binding-posts are mounted on the base. This little switch will find a number of uses where three different circuits are to be closed simultaneously.

An ordinary little single-circuit switch that can be put together in about fifteen minutes is illustrated in Fig. 5. Two springy brass strips are cut the same length. These should be about ½ in. wide. They are drilled out at each end to receive an 8/32 battery screw. They are fastened to the base with binding-posts. The free end of the lower spring is held in place with an 8/32 machine screw that also acts as a contact point. The upper contact piece carries a rubber knob similar to those employed on telegraph keys.

A very clever little reversing switch for use with voltage up to 110 and that will allow 5 am. to pass is shown in Fig. 6, *A* and *B*. A square base is cut out of oak. Six holes for binding-posts are drilled in this as shown. It will be necessary to countersink these holes underneath so that



Here are several different forms of simple switches, which are all useful in the laboratory

the heads of the screws will be flush with the surface. Six more holes are drilled halfway through with a ½-in. bit. The worker must take care to go only halfway through, as these holes are to form cups in which mercury is placed. The four corner holes are connected in the manner shown. This can be done with two insulated pieces of wire. Of course the insulation must be cut off where the ends of the wire dip into the mercury. A few small staples may be used to hold these connectors in place.

The handle for the switch is shown at *B*. The center portion of this is of wood and two brass ends are fastened to it. Three holes are drilled in each one of these end pieces to accommodate the corresponding number of heavy copper wires bent in the shape shown.

In bending these wires care must be taken that they are placed the proper distance apart as the end of each wire must dip into one of the mercury cups. The center wire should be a little longer than the other two so that when the switch is placed on one side it will rest there until it is pushed over to the other side. The two center pieces of wire go into the center mercury cups. The wires should be soldered in the metal ends of the handle. Only enough mercury is placed in the cups to make good contact.

When the switch is not in use, the mercury can be run off into a little bottle. It should not be left exposed, as mercury fumes are poisonous.

A simple little connector that will find a multitude of uses in electrical experiments is illustrated in Fig. 7. This is made by cutting off a piece of 1-in. brass stock. Four holes are drilled as shown. Four more holes drilled in from the periphery to the four holes first made are tapped out with an 8/32 tap. A No. 29 drill should be used. Four brass 8/32 machine screws are then placed into these holes. This little connecting-plate will be found very useful in wireless experiments.

Figure 8 shows another connector made from a solid piece of brass stock. The center of this is drilled out and two holes to accommodate 8/32 brass screws are placed in each end. A very good electrical connection can be made with this.

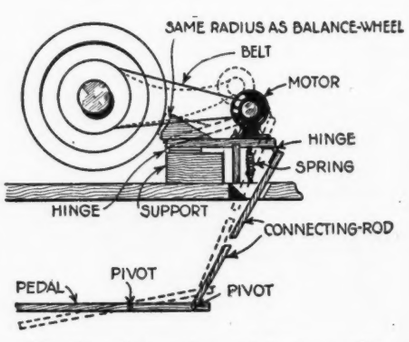
Electric Motor for Sewing-Machines

SIMPLE but efficient is this method of attaching a motor to a sewing-machine. A small electric motor of sufficient power to operate the machine is necessary.

A wooden block support is placed back of the balance wheel and screwed to the machine top from beneath. The motor is bolted to a piece of board for a base that is fastened to the support with a brass butt hinge as shown. A stop is placed directly under the motor. A strong coil tension spring is fastened to the motor base and the machine top to hold the motor in place and form the tension to keep the drive-belt tight. The drive-belt should be made so that it is at driving tension when the motor is down in position for operation.

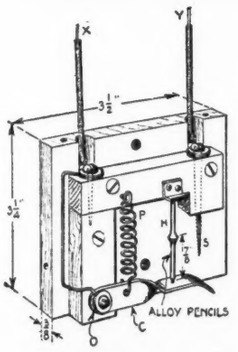
A light wooden rod is fastened to the rear of the pedal and hinged to the back of the motor base as shown in detail. A small brake of wood is then made and screwed to the front of the motor base, but its position can be found only by experiment. Wire the motor with flexible lamp-cord and place a small snap switch on the machine top in a convenient place.

To operate, it is only necessary to press down on the foot pedal and turn on the switch and when the motor is running to speed, gradually release the pressure on the pedal and the motor will drop back and take up the slack in the belt, thus starting the machine. To stop the machine, press on the pedal; that will raise the motor, loosen the belt, and apply the brake.



Pressing down the pedal stops the sewing-machine by causing a slack in the belt and pressure of the brake

Protect Your House with an Automatic Fire-Alarm



The trigger part of the fire-alarm

THE automatic fire-alarm here described is simple and inexpensive and can be made by any one with a saw and a few drills.

The perspective drawing will show the general construction and assembly. A light L-shaped wooden frame, screwed fast to a supporting back of the same material, carries on a pivot at *O* the twisted copper strip *C*, which is in electrical contact with one side of a circuit entering at *X*. The other side of the circuit enters at *Y*, terminating in the screw *S*, while a stout spiral spring *P* is so fastened to the bar *C* as to continuously tend to complete the circuit by pulling bar *C* down against screw *S*. The circuit, however, is normally held open by a column consisting of two pointed pencils made of Wood's alloy, shaped like short wire nails, the heads of which rest on each other as shown at *H*. When the column is placed in position as in the picture, the circuit can only be closed if the column collapses. This alloy melts at 163° F., and just as soon as the column softens enough to show a slight curvature, a state of inability results that causes the two halves to fly out sidewise, due to the force of the spring, and allows the bar *C* to be pulled down smartly upon the screwpoint *S*, thus making a very positive completion of the electric circuit.

The wooden casing enclosing the device should be painted or stained to match the woodwork of the room and should be placed at or near the ceiling of the room. Several instruments may be electrically connected in a variety of ways as follows:

1. A battery and bell may be attached to each instrument.

2. A central bell and battery may be bridged by any number of instruments.

3. A central annunciator and battery may have separate lines wired down from each instrument.

4. The last two methods may be combined.

Method 1 is adapted only to special cases and may be passed over as not of general use.

Method 2 will be found best suited to a majority of cases. The central bell and battery should be placed, say, in the bedroom and from it a single pair of wires will be led successively past each instrument in this and the other rooms, the terminals of the instruments being connected directly across the wires. In many cases the existing doorbell with its battery may be pressed into service as a fire-alarm by connecting the fire-alarm circuit to the bell and battery (or transformer), as shown in Fig. 2. This diagram illustrates the wiring of method 2, whether or not there is a doorbell circuit operated from the same battery. The instruments in the different rooms are designated by the numbers 1, 2, 3, 4, etc. This method is open to the objection that it would afford no clue to the exact location of the fire. In a dwelling, this would not be a serious matter, but if the premises are extensive, as on a farm with numerous buildings, in addition to the dwelling, a more definite means of locating the fire would be desirable. This can be obtained by using method 3, a diagram of which follows (Fig. 3).

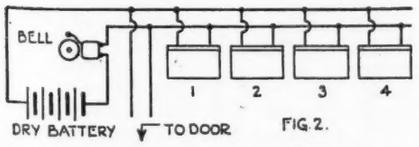


FIG. 2.

In this diagram four instruments are shown connected with the same bell and battery

The annunciator is merely a terminal box on which are mounted little pointers actuated by magnets connected in the individual circuits so that should the instrument on one circuit close, the pointer would immediately fly up and point to the number corresponding to that circuit, at the same time that the bell would ring. (In the diagram No. 3 is shown in action.) Thus the location of the fire is seen at a glance.

It is obvious that this method is more expensive than Method 2 and a combination of the two methods may often be used to advantage. For example, a man might have two instruments in his garage, on one circuit, four in his barn on another, and eight in his house on a third, all three circuits being brought separately to an annunciator. Then should the bell ring and the annunciator point to No. 2, he would know that the trouble was in his barn, though he could not tell which of the four instruments installed there was turning in the alarm.—HENRY A. GERMAIN.

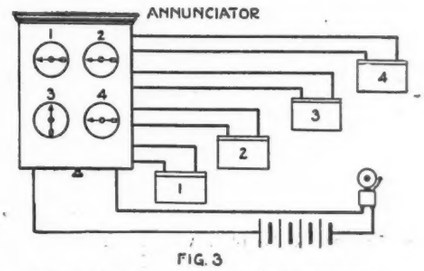


FIG. 3

Here the signal from each instrument is recorded on the corresponding annunciator dial

Coloring Makes Stereoscopic Pictures More Attractive

PHOTOGRAPHIC stereoscopic pictures become monotonous and dull after a while. The uniform shading, the monotone of gray with its few spots of black and white soon tire the observer.

The pleasure that can be derived from a stereoscope is greatly enhanced when the photographs are colored. Many colored stereoscopic pictures are sold, but only a few of them stand out in relief.

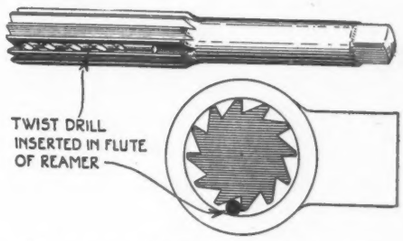
It is comparatively simple to color photographic stereoscopic pictures. Either one of the two pictures can be used and when properly colored with transparent water-colors, the effect, when seen through the stereoscope, is as if both pictures were colored.

It is not advisable to color both of the pictures, since it is almost impossible to get both exactly alike, and as the effect is the same when only one is colored, it would be a waste of time and energy to tint them both.—E. BADE.

When Reaming Is Done with Undersize Reamers

WHEN rebushing connecting-rods in the steering-gear, or spring shackles, it is frequently found that available reamers are either too large or too small. It is frequently suggested that pieces of tin be placed at the side of the reamer; but those who have tried this method will agree it is difficult to obtain satisfactory results.

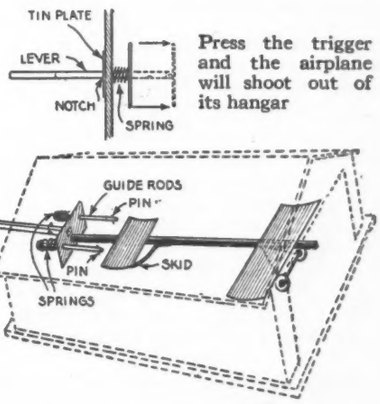
A method that serves to make a small reamer cut larger is to insert a small twist-drill in the flutes at one side of the reamer. The drills, being of hardened steel, will hold the reamer to the desired size and stay in the groove without sliding around. Drills graduated for size are usually obtainable in every tool-shop and their use with the reamer is very satisfactory.



Here is a trick worth knowing when you have to work with an undersize reamer

This Toy Airplane Will Shoot Out of Its Hangar

THE machine which is constructed after the monoplane type has a single rib for the fuselage. A little wire frame holds the wheels and a skidder is arranged on the tail. The rib of the airplane comes in contact with a little brass plate at the back of the hangar. This plate is mounted on two rods held in place by two nuts.



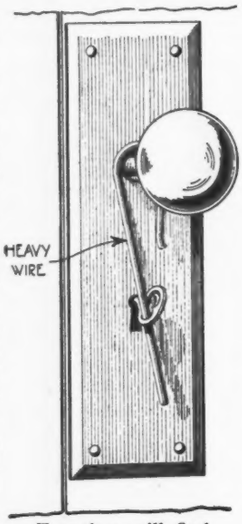
Press the trigger and the airplane will shoot out of its hangar

Two springs, one on each of the rods, are placed back of the brass plate. These springs are of the expansion variety. Attached to the center of the brass plate and extending through the back of the hangar is a small lever with a notch in it. When this lever is pulled back it pulls the plate with it and the notch holds the plate in position.

The airplane is now run in so that its tail will come in contact with the plate. If the lever is lifted, the springs will shoot the plate forward, forcing the airplane out of the hangar door at great speed. If the wings are properly adjusted, it can be made to loop the loop.—CARL ROYER.

Foiling the Burglar with a Piece of Wire

WHEN locking their doors, most persons think it sufficient precaution to leave the key in the lock to prevent the lock being picked or another key from being fitted from the outside. While this practice might foil the amateur housebreaker, it is of great assistance to the professional in gaining entrance. All well-equipped burglars carry an instrument resembling a slender pair of hollow-nosed pliers with which they can grasp the shank of the key and unlock the door as easily as if the key had been left on the outside.



Travelers will find this device a great protection

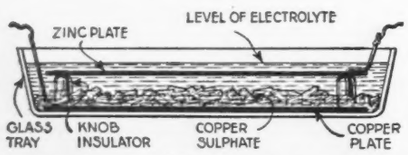
To prevent this, bend a piece of heavy wire, like the solid portion of a sash-curtain rod in U shape to fit over the door-handle, making one leg longer than the other, the longest leg extending 1 in. or more below the keyhole. Turn the key in the locked position as far as it will go and slip the wire through the key-handle, the other end passing over the door-handle. After this has been done, the key cannot be turned or pushed out from the outside and the lock cannot be picked.—H. C. ROWELL.

How to Make a Daniell Cell from Simple Materials

AMATEUR electricians know that a Daniell cell is best on closed-circuit work. It does not polarize rapidly and is therefore well suited to the needs of the amateur electrician's laboratory. A few cells will produce sufficient current to operate small motors, bells, etc.

The materials entering into the construction of the cell are not costly. First obtain a few of the old type glass photographic developing-trays, which may be purchased for a few cents apiece. If these cannot be obtained, any good flat receptacle about 2 in. deep and 8 in. square will do.

The general plan of construction will be evident upon referring to the illustration. A piece of sheet copper is placed on the bottom of the container. This copper can be obtained at any hardware store. Nothing but copper can be used for this element. Four small knob insulators, such as those used between floors by electricians, are used in separating the zinc plate from the copper plate. One of these is placed in each corner of the tray. The sheet zinc should be about 1/16 in. in thickness. This may also be purchased in any hardware store. About ½ lb. of copper sulphate crystals (commonly called blue vitriol) is placed over the copper plate and the bottom of the cell. Water is now poured in to within ½ in. of the top.



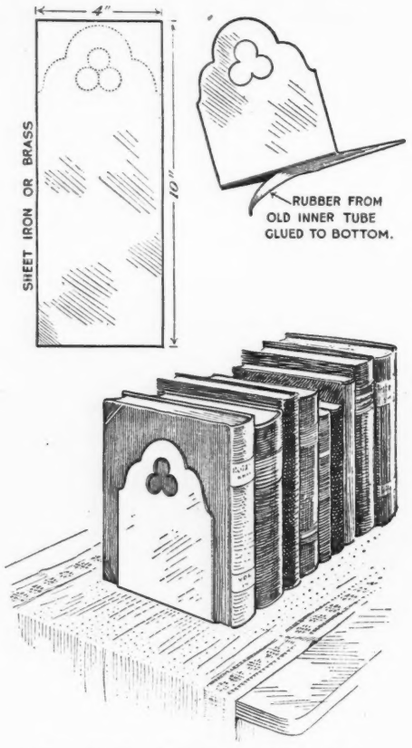
Here is a Daniell cell of the low-dish type, but any other form will serve

The cell is placed on short circuit for three or four hours. In placing it on short circuit it is necessary merely to connect the copper and zinc plates together by two wires. These wires should be soldered to the respective plates. The voltage of the Daniell cell is 1.07 and of course this potential is produced regardless of the size of the area of the plates. The current strength will depend upon the area of the plates and the distance they are apart.—W. H. HOSCHKE.

Artistic Book-Ends of Sheet Metal

YOU can make a very artistic and practical set of book-ends from two pieces of sheet metal, 4 in. by 10 in., either brass or iron, rigid enough not to bend easily.

While the metal is still flat, some design can be cut and filed out at one end. The steel points of an ordinary compass will trace the lines sufficiently clear for cutting. The design shown in the illustration is practically all drawn with the compass and is not difficult to make.



These book-ends are practical and may also be made ornamental

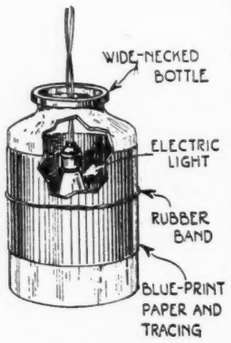
After the design has been cut out of the two sheets of metal, bend each piece in the middle to a right angle. A little care should be taken to see that the bend is straight and squarely done.

A thin flat piece of rubber from an old inner tubing can be glued to the under side of the book-end to prevent slipping and also any marring or scratching.

If made of brass, it will polish nicely and if made of sheet iron, it can be gilded or bronzed or tinted as the fancy dictates.—M. J. MUNSON.

A Blue-Print Machine from an Old Bottle

BEING badly in need of a blue-print frame and having none at hand, the writer set his mind to work to devise a substitute. The idea of using a large glass bottle flashed into mind and it was found to be very successful.



If the light is in the center, all parts are illuminated

An electric light is placed in the center. The mouth of the bottle should be large enough to accommodate a 40-watt lamp. One of the large bottles in which malted milk is sold should be used. The tracing and the blue-print are placed together and wrapped tightly around the bottle. Several elastic bands are used to hold them in place. When this is done the light is turned on and the blue-print is exposed.—JOSEPH B. MORAN.

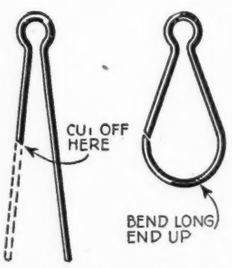
How a Simple Snap-Hook Was Evolved

SHOULD you be short of a snap-hook, here is a quick method of manufacturing one:

Take a cotter-pin large enough for the purpose and cut off one tine about halfway down its length.

The ends of each tine should then be beveled so that when the long one is bent around to meet the short one, as shown, the beveled ends will be in contact.

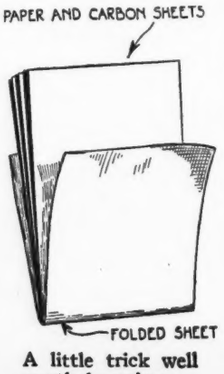
If the snap-hook is then hardened to gain more springiness, it will be found very serviceable.—L. B. ROBBINS.



Make a snap-hook out of a cotter-pin

To Insert Several Carbon Copies in Typewriter

WHEN you have to use carbon sheets for printing more than one copy on the typewriter, it is troublesome to get them in the typewriter. You can save time and trouble if you will take one sheet of paper, double it; put it over the ends of the paper that is to go in the typewriter, as shown. You will find that you have no trouble getting it started in. Run it through far enough to remove the doubled sheet.—D. S. WRIGHT.

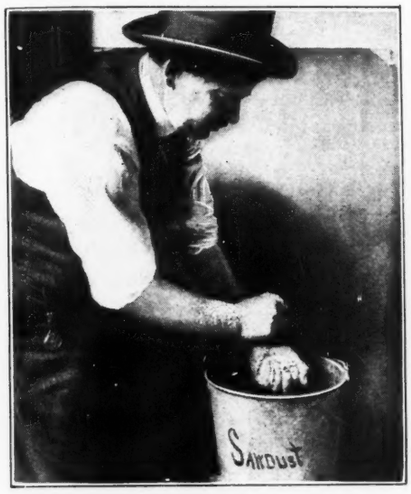


A little trick well worth knowing

Sawdust Is a Good Cleanser of Oily Hands

IN machine-shops and factories where the machinery requires constant lubrication, the hands of the workmen often become coated with oil or grease. In many establishments the men use rags and gasoline or benzine for cleaning their hands. But oil-soaked rags and gasoline are highly inflammable and constitute a serious fire hazard.

A manufacturing concern in Ohio has solved the problem by providing large cans filled with sawdust in the different parts of



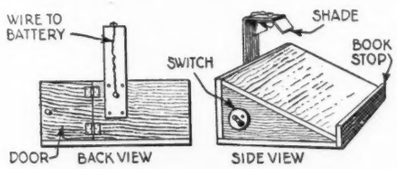
Oily or greasy hands may be cleansed with dry sawdust, which soaks in the oil and scours the skin

the factory. The workman who wishes to remove the oil from his hands, takes a handful of sawdust from the nearest can and thoroughly rubs and scours his hands with it. The sawdust soaks in the oil and gives enough friction to cleanse the skin without injuring it. The sawdust so used is collected and may be used to soak up any oil that may have been spilled on the floor.

Use This Book-Rest with a Lamp Attachment

HERE is a book-rest that will hold the book in the desired position and that will at the same time provide you with sufficient light to read the book without undue strain on the eyes.

It is constructed with ¼-in. boards, as shown here. A piece of brass is bent into



Eye-strain from reading at night may be avoided by the use of this book-rest and shaded lamp

the shape indicated, a small reflector is soldered on, and a small hole made for the socket. This, in turn, is screwed to the book-rest.

A switch is provided at the right side of the book-rest. A door is made large enough so that the battery can be put in or removed when dead. A strip of felt can be glued to the under side of the book-rest if desired.—WILLIAM E. KING.

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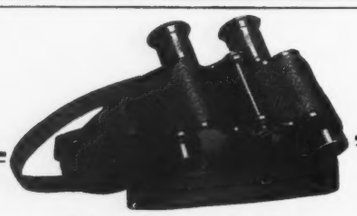

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New Uses for Electricity

Have you found a new way of making the electric current work for you? Have you made a new labor-saving or money-saving machine or device that is electrically operated? The Popular Science Monthly will pay $90 in prizes for the best answers

ELECTRICITY is one of our most useful servants. An outline of its more common daily uses would fill a book of no mean size. The editors of the Popular Science Monthly want to find some uncommon uses for electricity. They want to know what new uses readers of the magazine have found for it in home, shop, or office. The new machine or device does not need to be motor driven, although there is no objection to a motor-driven machine, provided it is new and useful. It must, however, be a homemade device. Electric magnets, solenoids, or heaters may be employed.

The Popular Science Monthly offers three prizes for the best answers—a first prize of $50, a second of $25, and a third of $15. These will be awarded in accordance with the rules outlined below.

Rules Governing the Contest

(1) Contestants are not limited to the number of ideas, but only one method can possibly win the first prize, only one the second, and only one the third. The contest is open to everybody.

(2) The use of the new electrical appliance must be shown clearly, either in a photograph or in a drawing. If a drawing is sent in, it need not be made by a skilled draftsman. It is sufficient that it should be intelligible. While pencil sketches will be considered, contestants are requested to make their drawings in ink on heavy white paper. The views should be sufficient in number to set forth the writer's idea very clearly. The contestant's name and address should appear on each sheet of drawings.

(3) The drawings or photographs must be accompanied by a description, preferably typewritten, in which the method is clearly given. It must be written on one side of the paper only, and it should not be more than 500 words in length. The name and address of the contestant should appear in the upper left-hand corner of the first sheet of the written description.

(4) The drawings and description entered by contestants must be received by the Popular Science Monthly not later than 5 p. m., on Oct. 20, 1921.

(5) The judges of the contest will be the editors of the Popular Science Monthly.

(6) The first prize of $50 will be awarded to the contestant who, in the opinion of the judges, has suggested the best idea of a new use for electricity.

The second prize of $25 will be paid to the contestant who submits an idea next in merit.

The third prize of $15 will be paid to the contestant who submits an idea third in merit.

(7) The winners of the contest will be announced in the earliest possible issue of the Popular Science Monthly. A description of the ideas that win the three prizes offered will duly appear in the pages of the Popular Science Monthly, together with the names of the winners.

(8) The editors of the Popular Science Monthly shall have the right to publish meritorious manuscripts that do not win a prize. The regular space rates will be paid to the contestants who submit the manuscripts thus selected.

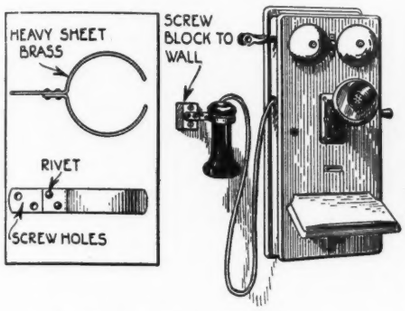
(9) When a contestant submits more than one idea, the description and drawing by which each is set forth must be sent as a separate unit.

(10) Manuscripts or drawings will be returned to contestants if stamps are enclosed.

(11) Send drawings and specifications to the Editor of the New Uses for Electricity Contest, Popular Science Monthly, 225 West 39th Street, New York City.

An Extra Hook for the Telephone Receiver

WHEN a person is called to the telephone the receiver is often left dangling at the end of its cord. A little device that will eliminate this inconvenience is illustrated herewith. It is an

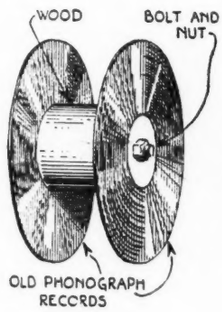


Do not let the receiver of your telephone dangle from the wires. Provide a hook for it

extra hook made of stout sheet brass. It will be necessary to cut two strips of brass and rivet them together as shown.

Making Good Use of Old Phonograph Records

SCRATCHY phonograph records are usually consigned to the ashcan. Here is a use for records bearing heavy scratches. Of two of them and a cylindrical piece of wood, a splendid spool for wire or cord may be made. The wood cylinder has a hole through it and a small machine screw is passed through this. Nuts hold the pieces together.



This spool was made with two old records

Use large washers under the head of the bolt and under the nut.

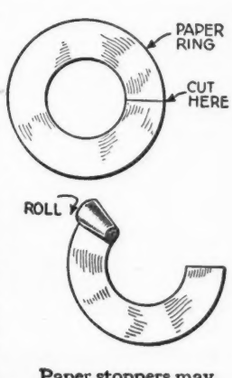
The little ten-cent records make very good small spools. — JOSEPH B. MORAN.

Model Your Own Stoppers from Paper

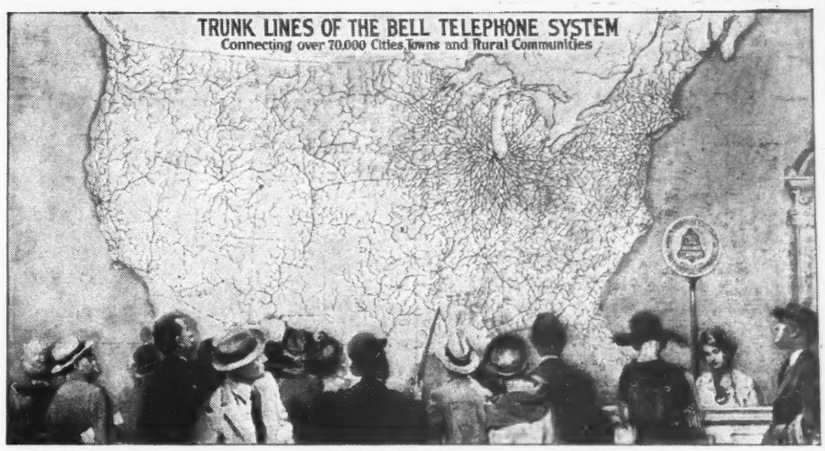
DURABLE stoppers of almost any size may be made from paper.

Take a sheet of glazed paper and cut out a circle as shown. The size of the finished stopper will depend on the diameter of the circle; the length of the stopper will be equal to the width of the paper ring.

Now cut through one edge, and roll the paper tightly as shown, applying a little paste in so doing. Allow the paste to dry and dip the stopper in paraffin to make it waterproof.



Paper stoppers may be made in this manner



UNITED STATES		BELL SYSTEM	
Population	107,100,000	Telephones owned and affiliated	12,600,000
Square Miles	3,027,000	Miles of wire owned	25,400,000
Number of Post Offices	52,600	Number of Employees	270,000
Miles of Railway (1916)	250,000	Stockholders	150,000
Passengers carried	1,191,000,000	Telephone Messages	11,033,000,000

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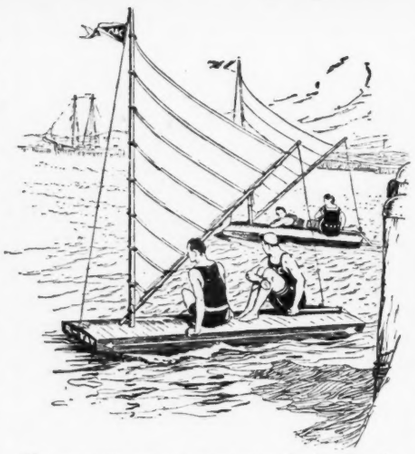
Why Not Make a Skip-Jack Sailboat?

THIS skip-jack sailboat can be put together for about twenty dollars and many hundred dollars worth of pure fun may be had with it in a single season. The boat is really a scow with a sail on it. It is splendid to swim from, since it will not tip. It must be admitted right here that this is not a rough-water boat.



On smooth waters you may derive much pleasure from this craft; try to build one

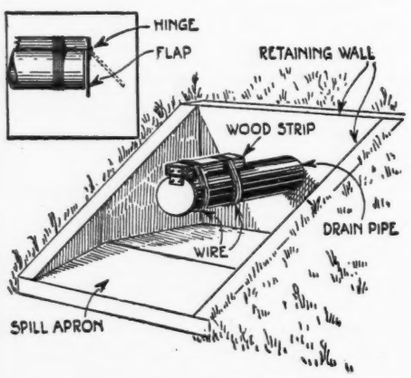
The frame of the craft is made with 1-in. timber. The bottom boards, which run crosswise, are ¾ in. thick. Only matched lumber should be used for this purpose. Two heavy ribs made of 2-in. material run down the center of the craft. and form a well that runs the length of the boat. A centerboard or keel is made to fit into this well. This board is so arranged that it may be lifted up out of the water.

The depth of the craft should be about 1 ft., although this will depend upon the judgment of the builder. The top of the craft is made slightly round to allow the water to run off. A length of 12 ft. and a width of 3 ft. will make a boat sufficiently large to hold three to four persons. All of the crevices should be filled up with putty, marine glue, or coal tar and the outside of the boat must be given at least two coats of good paint. It is provided with a simple rudder.

A mutton-leg sail is carried. This should measure about 10 ft. on every side. The mast of the sail is held in a socket made of a short length of iron pipe. This is provided with a capped end and set in flush with the deck. Such an arrangement prevents water from getting into the hold of the boat.

You Should Protect the Drainpipe Outlets

OUTLETS of drainpipes should be protected from the caving in of the surrounding earth and from the entrance of rodents. Dirt caving in at the end of the drain causes the water to back up into it and sediment to settle, eventually clogging



Here the proper way of constructing a drainpipe outlet is shown. The flap will keep out the rats

up the pipe. Vermin and rodents enter and sometimes are killed, thus stopping up the drains.

The illustration shows how to protect the end of the drainpipe with a concrete curb, also the method of preventing rodents from entering. A concrete retaining wall should be built around the drain end and a spill apron extended as shown to prevent the dirt from being washed out and undermining the structure.

The retaining wall is not built until the drain is in place and it should be so built that the end of the drain projects about 12 in. beyond the wall.

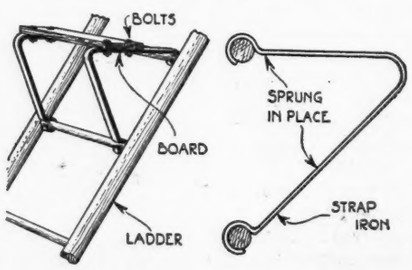
A hinged metal flap cut from some light-weight tin or sheet iron and of a slightly larger diameter than the drainpipe is used to close the end of the pipe. Probably a sheet of zinc or copper would prove more satisfactory as it would not rust. A brass hinge is riveted or bolted to one side of the flap and then in turn screwed to the end of a piece of hard wood about 12 in. in length.

This piece of wood is placed along the top of the pipe and securely fastened to it with copper wire as shown. With a little adjustment the flap will hang over the end of the pipe. It will open automatically to allow the waste water to pass out, but will prevent anything from entering.—B. FRANCIS DASHIELL.

An Adjustable Platform Step for the Ladder

WHEN doing much work on a ladder it is very tiresome to stand for a long time on the rungs. This small step or platform bolted to the ladder will make the work much easier.

Two straps of flat bar iron are bent into the shape shown in the illustration. The loops in the bent ends of the straps are just large enough to slip firmly over the rungs of the ladder. An oak board 12 in. wide and equal in length to the width of the ladder, is securely bolted to the two iron



Working while standing on a ladder becomes less tiresome if you can rest on a platform like this

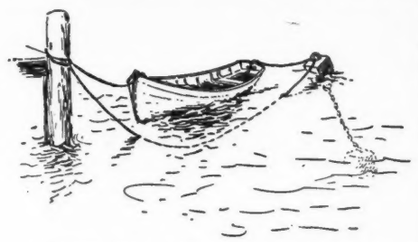
straps as shown. If care is used in the construction and the board is not too wide nor too long, it will be an easy matter to step on or over it from above or below.

Moor Rowboats to Prevent Them from Chafing

WHEN rowboats are moored to the shore or a dock by a bowline, the wind, tide, or current tends to swing them back and forth and chafe them against permanent projections.

This can be remedied as follows: Drop a heavy mooring anchor about three boat-lengths from the shore. A wooden buoy, attached to the mooring by a chain, floats on the surface of the water. A pulley is attached to the buoy. Attach one metal ring to the bow and another to the stern of the boat, and provide a strong mooring-rope long enough to reach from the shore to the mooring and back again. Fasten a snap-hook to each end.

Run the rope through the pulley and snap one hook to a ring on the stern of the boat as shown. The rope is slung over a mooring-cleat on the pier and the free end with its hook is snapped on the ring at the



If your boat is moored in this way, it will be safe from injury by chafing against the pier or post

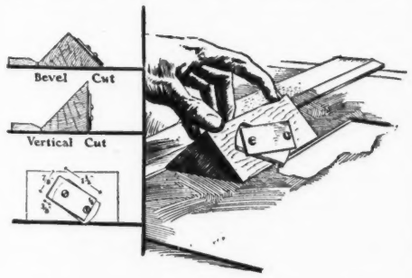
bow. Then, by pulling the rope one way or the other, the boat can be run out to the buoy or brought to the shore.

The hooks are snapped together when the boat is unfastened around the cleat on shore.—L. B. ROBBINS.

Try a Safety-Razor Blade for Card-Cutting

A SERVICEABLE little device for cutting and trimming paper or cardboard or for bevel cutting, such as is required in making mats, can be easily made by utilizing discarded safety-razor blades.

The device as shown includes a short hardwood block, triangular in cross section.



Paper or cardboard may be cut with an old safety-razor blade attached to a prism of wood

On one of the right-angle surfaces of the block a brass plate 1½ in. by ⅞ in. by 1/16 in. is fastened by two screws located ⅜ in. and ⅛ in. respectively from the ends of the plate. These screws pass through the two holes in the razor blade for vertical cutting or, as shown in the perspective view, through one hole.

The inclination of the plate on the face of the wood block should be about 30 degrees to the bottom edge to obtain the best results.—EVERETT ROGERS.

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30x3½	8.60	33x4	11.75	34x4½	14.00	35x5	15.50
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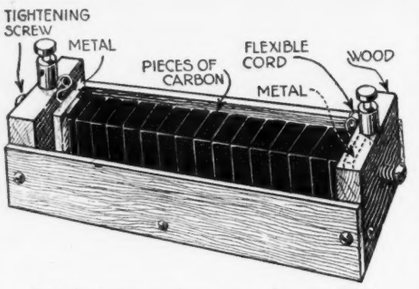
How to Make a Carbon-Pile Rheostat

A CARBON-PILE rheostat is a form of resistance that is very useful in the small laboratory. It is surprising how few amateur electricians know of this device.

In a pile of flat pieces of carbon the electrical resistance will depend upon the contact between the individual pieces, and this contact will in turn depend upon the pressure applied. With a very light pressure the electrical resistance will be high, and with a heavier pressure the resistance will drop.



Old battery carbons are the material from which this useful rheostat for the small laboratory may be made

If the pressure is applied gradually, the resistance, of course, can be varied accordingly.

The carbon pile used in the little rheostat shown in the illustration is made by cutting up old battery carbons. These should be cut carefully so that they will fit smoothly together.

If you should have a lathe at hand, the cutting can be done on that; otherwise a hacksaw can be used. If a hacksaw is used, an improvised miter box must be pressed into service to insure accurate cutting. After the pieces of carbon are cut out they should be treated individually with a smooth file.

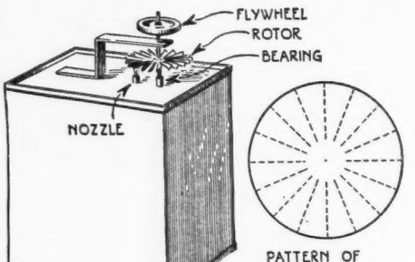
The workman will now be ready to proceed with the construction of the little wooden frame that holds the blocks. Each of the end pieces has a heavy wooden screw through it. These screws are used to adjust the pressure on the plates. The pointed ends of the screws come in contact with metal pieces between which the carbon pile is pressed. If the screws were allowed to press into the carbon pieces, the carbon pieces would break.

A binding-post is then mounted at each end of the rheostat and a flexible cord connects the binding-posts with the metal plates.

The device is used in the same way as an ordinary rheostat and the resistance is adjusted by using a screwdriver. Considerable current can be passed through this carbon-pile resistance without causing an appreciable increase in the temperature of the composing elements.

Steam Turbine with a Tin-Can Boiler

THIS little steam turbine will give the boys a great amount of pleasure. The boiler is made from an old tin can. The best type of can is the kind that syrup comes in. Such cans are provided with a tight-fitting cover.



The principle of the steam turbine may be clearly illustrated by this home-made apparatus

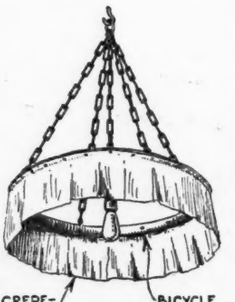
A little arm of metal is soldered to the top of the can as shown. A hole is drilled in one end of this to act as a bearing for the shaft carrying the rotor. The rotor is made from a piece of light tin about 1½ in. in diameter. This is cut with shears as shown. The blades are then bent into a fan shape by twisting them around slightly. They should all be twisted in the same direction.

A hole is drilled through the center of the rotor. A piece of heavy wire is forced through the hole and held with a drop of solder. A circle of sheet brass is cut out and a hole drilled through the center so that it will fit over the shaft carrying the rotor.

The opposite end of the rotor is first filed to a point and a little piece of brass is drilled out so that it will accommodate this pointed end of the shaft. This is really an improvised thrust-bearing. The brass-bearing piece is soldered to the tin can so that the hole will come directly under the hole in the bearing-arm that was previously soldered in place. The fly-wheel is also held in place with a drop of solder. A nozzle made of a small piece of brass tubing is then placed in the position shown. It will be necessary to drill a hole through the cover to accommodate this. It is held in place with a drop of solder. The can is now filled one quarter full of water and placed on a hot stove. In a few minutes the little rotor will begin to spin.—L. LAURIER.

A Chandelier Devised from a Bicycle-Wheel Hoop

OLD bicycle-wheel hoops can be used to make chandeliers suitable for use in a summer cottage or the den. Four chains are attached to a hoop. These meet at the top, where they are attached to the fifth chain, which reaches to the center of the hoop. This chain is attached to an electric-light socket and the wires run down the chain.



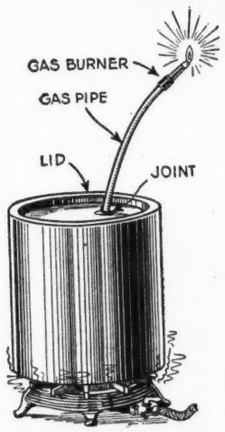
Beautify your den with a chandelier like this

If the builder desires, he can cut a piece of composite board to cover the top. The light drops through the center. Crêpe-paper of any color desired is cut and put around the edge of the hoop as shown in the illustration.

You Can Produce Gas from Old Newspapers

OLD newspapers yield a considerable volume of illuminating gas when used as described below.

Get an old syrup-can complete with an airtight fitting lid. Punch or drill a hole in the lid to receive a length of ¼-in. brass gas-piping, and make a good joint.



Making gas from old newspapers is an interesting experiment

Now fill the can with old newspapers, close the can with the airtight lid, and place the retort over a fire.

In three or four minutes a gas will issue from the brass pipe, and on applying a match, will burn with a luminous flame until the paper in the retort is used up.

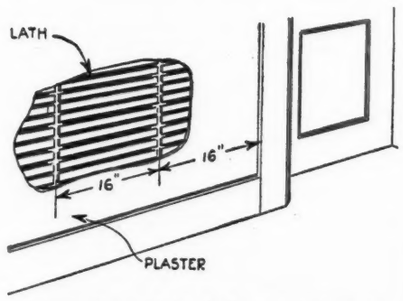
If desired, a length of rubber tubing can be connected with the retort pipe to convey the gas wherever wanted.—GEORGE H. HOLDEN.

Nails Hammered in the Wall so They Will Hold

IN order to nail anything to a lath-and-plaster wall, follow these directions.

Inside the wall are upright timbers to which the laths are nailed, these are almost invariably 16 in. apart, so all that you have to do is to measure one or a series of 16 in. from a door or window or corner, and you will find firm holding, but it is well to test with a fine bradawl before driving a heavy nail.

If you want to hang a heavy object and cannot do it just where the upright comes, nail a strip of wood from one to the next, and fasten to that. A light object may be



Locate the uprights before you attempt to drive any nails in your walls. It will save you trouble

hung to a lath by boring first and then using a fine screw, letting it work its way gently into the lath.

If you wish to fasten anything to a concrete wall, which turns the points of the nail, carefully remove a few inches of the wall-paper, then with a small cold chisel or old screwdriver or twist-drill make a hole ½ to ¾ in. round and deep enough for your nail; into it drive tightly a wooden plug fixed with plaster of paris or cement, smooth it over, replace the wall-paper and drive in your nail or screw.

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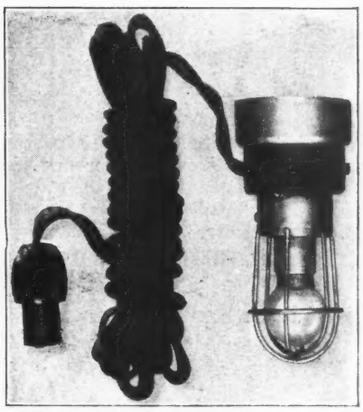

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ON a dark country road, dim side street or in poorly lighted garage, **Magnet-Lite** stays right where you put it and puts the light exactly where you want it. By means of the powerful electro-magnet in its base, it sticks like a burr to any metal part of your car. It requires no holding and leaves both hands free to examine, adjust or repair.

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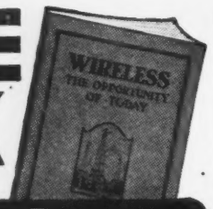

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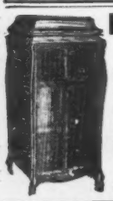

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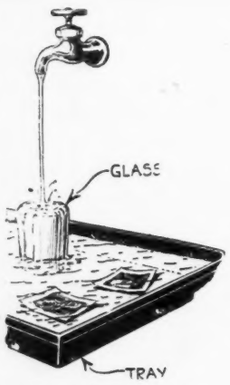
Here's an Idea on Washing Photographic Prints

HERE is a good suggestion for the amateur photographer. When the water is allowed to run full force into the photographic washing-tray, a current is created. The prints come in contact with one another and stick together. They are prevented from receiving the proper amount of washing in this way.



This illustrates a good method of washing prints

A glass placed in the tray prevents this. The water from the faucet is allowed to fall into the glass. It overflows from this into the tray. This causes very little disturbance and practically no current is produced, although the tray receives sufficient water.—GEORGE BENDER.

How to Remove Kinks in Wire

Simple and effective for taking kinks out of wire

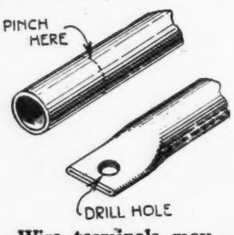
WHEN I needed wire of a gage that I did not have at hand, I obtained a helical spring and uncoiled it. To remove the kinks that remained in the wire, I fastened one end to a hook in the wall and the other to a large weight. Then I looped the wire around a short metal rod and drew the rod back and forth several times, thus removing the kinks. — FRANK HARAZIM.

Wire Terminals Made from Brass Tubing

THE amateur mechanic may make his own wire terminals for electrical work if he has on hand a few feet of copper or brass tubing of the right diameter.

The tubing is first cut off the proper length in the lathe or with a hacksaw. If a number of the terminals are to be made, it is best to cut them off in the lathe, since this produces a neater job.

When this is done, the pieces of tubing should be heated and allowed to cool slowly. This will anneal the metal. The ends of the tubing are then pinched together in the vise.



Wire terminals may be made from metal tubing

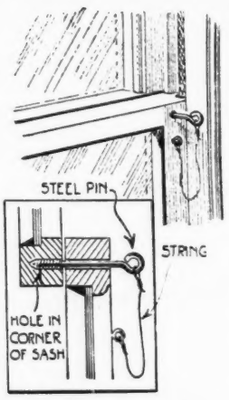
A hole of the right diameter is then drilled through the flat end and the terminal is completed and all ready to be used.—CARL ROYER.

This Window-Lock Will Actually Lock

SIMPLE and as nearly burglar-proof as possible is the window-lock that is shown below. All that is necessary to construct this lock is a small drill and some round steel rod.

Close the windows and drill a hole through one corner of the bottom sash and not quite through the upper one.

Then make a pin of the steel rod with an eye in one end. The pin should be long enough to go clear to the bottom of the hole in the upper sash. A cord tied to the eye and to a screw-eye in the sash will prevent the pin from dropping to the floor and becoming lost.



This pin with the screw-end locks the window

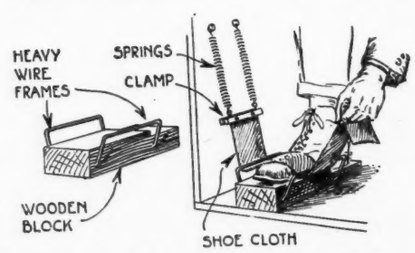
With the pin shoved home in the two holes there is no way for a burglar to remove it without removing the glass and he cannot raise or lower either sash without smashing them to pieces if good steel is used for the pin.

To prevent the pin from working itself loose, the end of the pin should have a few threads so that it can be securely screwed into the hole of the top sash of the window.—L. B. ROBBINS.

Build This Shoe-Polisher at Home

WITH this little machine much of the hard labor is taken out of cleaning shoes.

Using this device the shoes can be polished with one hand. One end of the rag is placed between a wooden clamp attached to the end of two window-shade springs.



Back-strain from stooping while polishing the shoes may be prevented by the use of this mechanical device

The rag then passes through two wire frames mounted on a wooden block as shown above. The foot is placed on this block with the rag over the top. Pulling on the free end of the rag will cause it to move back and forth over the shoe.—MATTHEW POTTS.

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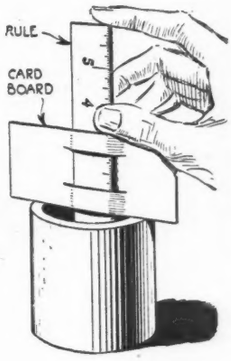
Improvising a Depth-Gage in an Emergency

THE depth of a hole can be measured very well with this little improvised depth-gage which is made of a ruler and a piece of cardboard. Two slits are cut in the cardboard to enable a pocket ruler to pass through them. The cardboard should be fairly stiff so that it will stay in whatever position it is placed on the ruler. The illustration shows the method of using the improvised gage. — L. LAURIER.



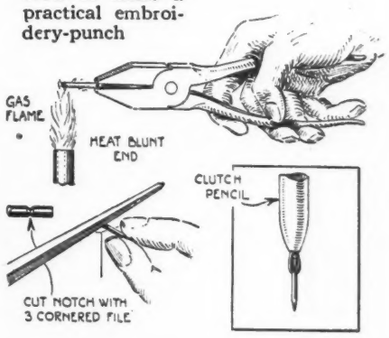
Use slit cardboard for making this depth-gage

A Homemade Punch for Use in Embroidering

A HANDY punch for embroidering, etc., may be made of a phonograph needle and a common clutch pencil. The sketches below illustrate the several simple steps involved.

The thick or so-called "loud" needle is most suitable Soften its blunt end by

How to make a practical embroidery-punch



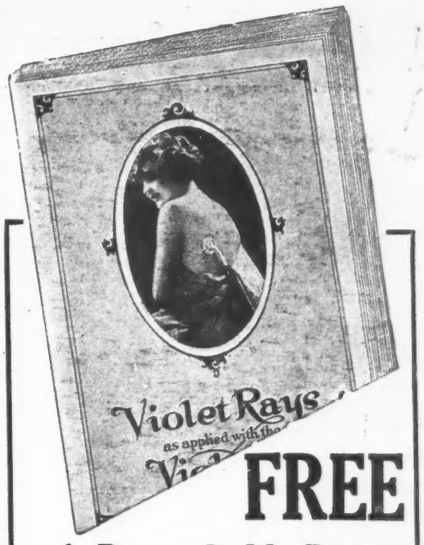
heating it in the gas flame until it is red-hot—then allow it to cool. Cut a fine indentation all around at the blunt end of the needle. A jeweler's file is the best for the purpose. The point can also be inverted in the clutch to carry the punch in the pocket. Of course the pencil is in no way impaired.—C. NYE.

To Produce a Black Stain on Polished Brass

BELOW is described a dip for black on polished brass parts that is recommended by an authority:

Liquid ammonia—3 gal. Saturate with carbonate of copper to excess. That is, add the carbonate of copper as long as it dissolves and then add more so that there is a marked excess. Then add water—1 gal.

Clean articles in potash, rinse, dip in cyanide, rinse and immerse in dip, having the dip stirred up well. When black, remove, rinse, and dry. When the dip is not in use, keep it well covered. When it becomes weak, add more carbonate of copper and ammonia.



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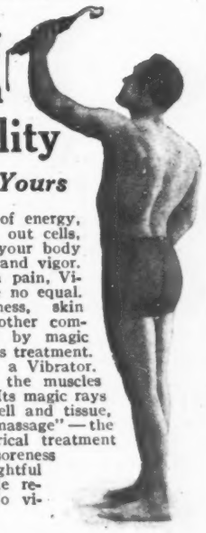

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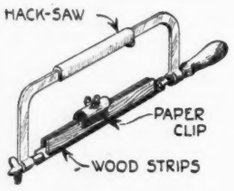
Popular Science Monthly
225 West 39th Street, **New York**

How You Can Economize on Hacksaw Blades

HACKSAW breakages will seldom occu if the following simple device is used. It may be made from a few strips of hard wood ⅜ in. wide by ⅛ in. thick and about the length of the saw-blade. One strip of wood is placed on each side of the blade in the frame, and a paper clip then grips the whole tightly so that the saw back is held rigid during use.

Of course, one can employ this method only on small work, but it gives more confidence in working on the heavier material.—GEO. H. HOLDEN.



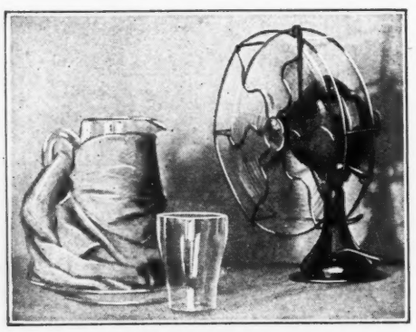
This device means a saving in hacksaw blades

Cool Beverages without the Use of Ice

PRACTICAL and simple is this method of cooling beverages so that they are refreshing as well as palatable. It is based on the rapid evaporation of water. The liquid to be cooled is placed in a preferably thin-walled container. Around this is wrapped a towel well soaked with cold water. This is then placed in the direct current of air produced by an electric fan.

Care should be taken to have the towel neither too thick nor too wet. Lacking an electric fan, the towel-wrapped container may be placed in an open window, but the electric fan produces a stronger and more dependable air current than stray breezes afford.

This method of cooling drink was used by the ancient Egyptians. Jars of baked Nile mud, which were semi-porous and which allowed a certain amount of evaporation, were filled with the none too clean



Modern application of a principle known to and utilized by the ancient Egyptians

Nile river water and then set in the cool shade. The native Egyptians use this method to-day and it well answers the purpose in a country where, save in hotels frequented by tourists, the use of ice is unknown.—W. T. PERRY.

News-Drawings Can Be Easily Transferred

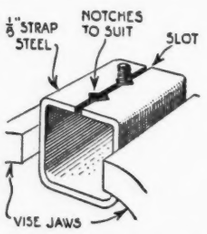
MELT ⅛ oz. yellow soap in 10 oz. of hot water and when cold add 2 oz. of turpentine. Float the picture in this and when it has absorbed all the moisture it can, place it face down on a piece of bristol-board, absortb he superfluous moisture with a piece of blotting-paper, lay a piece of tracing- or wrapping-paper over this, carefully fixing one edge with pins or glue so that it will not move, and rub from the fixed edge with a burnisher, and your picture will come cleanly on to the board.

A fair impression may be obtained by lightly rubbing the picture with a paraffin-wax candle and then placing it face down on the paper or board, rubbing the back with the burnisher. The fingernail makes a fair burnisher.—E. A. MCCANN.

For Holding Screws in a Vise with a Clamp

THIS simple little clamp is very useful in the workshop to hold small screws securely so that it is possible to file or saw them.

It is made of ⅛-in. strap steel about 1 in. wide and 6 in. long. It can be quickly and easily made by first filing the notches in the jaws to the depth desired and bending the ends in a vise at right angles to the strip of metal.



The notches are cut to hold different sized screws

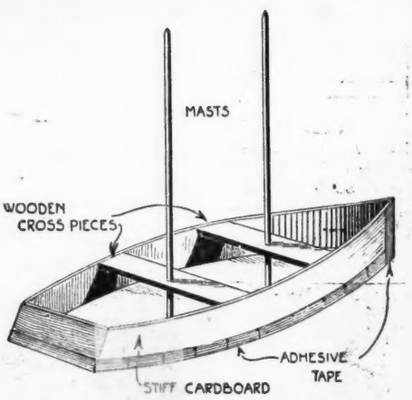
The two ends are then bent around a piece of pipe until they nearly meet.

Tempering is unnecessary as the little spring needed will always be left in the metal. When a screw is placed in the notches and the clamp is inserted between the jaws of a vise, there is little chance for the screw to slip. As many as three notches may be cut in the jaws of this clamp to accommodate various sized screws.

Toy Boats Constructed with Pliable Cardboard

A FAIRLY pliable cardboard may be used to construct toy boats. The bottom, sides, and stern can be cut out as shown. Adhesive tape is pasted along the edge inside and outside. This tape must be slit at intervals so that it will take a curve without buckling.

The boat is immersed in a pan of hot paraffin and allowed to remain there several minutes. It is taken out and cooled off and then given a coat of shellac. A water-tight little craft can be produced in this way. The cross pieces are merely glued in.—JOSEPH B. MORAN.



Children will derive great enjoyment from playing with this water-tight little craft

To Hang Things Upon a Needle Point

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will safely hold heavy pictures to the walls. Note the scientific angle to the point. For light pictures, use the world-famous **Moore Push-Pins.** Neither will mar wall paper, plaster or wood work.

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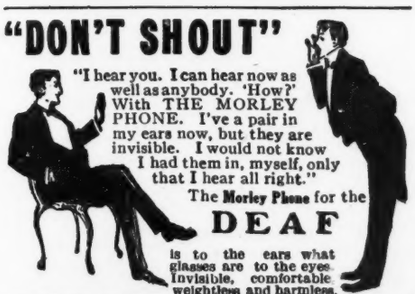

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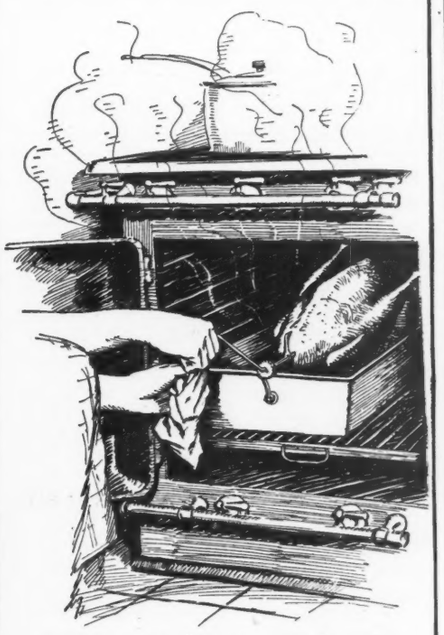
Add a Revolving Roaster to the Kitchen

HOUSEKEEPERS who do their own cooking will find the revolving roaster here described and illustrated a valuable addition to their kitchen equipment. The roasting-rod or -spit should be of iron or steel, a few inches longer than the roasting-pan.

When in use, the spit rests in the bearings riveted to the edge of the end parts of the pan. One end of the spit is bent to form a crank with a handle. A ratchet wheel is driven on the spit to a point near the handle and engages a spring riveted to the end piece of the pan.

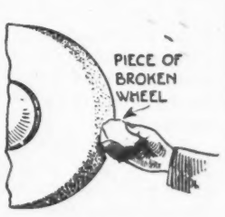


By the addition of this revolving spit to the roasting-pan cooking will be made much easier

The fowl or meat to be roasted is perforated as nearly as possible through its center by the spit. The rod is then placed in position in its bearings so that part of the roast is submerged in the gravy at the bottom of the pan. By means of the crank the roast may be turned to any position so as to bring different parts in contact with the gravy. It is not necessary to take the pan from the oven to change the position of the roast. A slight turn of the handle from time to time is all that is necessary till the roast is browned.—W. A. JACKSON.

One Way of Truing Up the Emery Wheel

GRINDING-WHEELS get out of true very easily. In the smaller shops the mechanic does not always have a wheel-truing device at hand. A good substitute will be found in a piece of a broken wheel. If this is held against the surface of a revolving wheel, it will true it up quickly, but it must be held to the wheel with considerable pressure. — JOSEPH B. MORAN.



An effective method of truing a grinding-wheel

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Automobile Repairman $2,500 to $4,000	Employment Manager $4,000 to $10,000
Civil Engineer $5,000 to $15,000	Steam Engineer $2,000 to $10,000
Structural Engineer $4,000 to $10,000	Foreman's Course $2,000 to $4,000
Business Manager $5,000 to $15,000	Sanitary Engineer $2,000 to $5,000
Certified Public Accountant $7,000 to $15,000	Telephone Engineer $2,500 to $5,000
Accountant & Auditor $2,500 to $7,000	Telegraph Engineer $2,500 to $5,000
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Safety-Razor-Blade Holder from a Clothespin

DISCARDED safety-razor blades may be used for ripping seams, by the photographer for cutting masks or mats and in many other ways.

The difficulty of their use lies in the inability to comfortably handle them alone.

If the handle of your safety razor is lost, use a clothespin

A clothespin, though, can be turned, in a few minutes, into a very satisfactory handle for the blades. A small hole is bored through one prong of the pin halfway between the end and the base, and a screw inserted in the hole. By tightening the screw the prongs of the clothespin close, and by inserting a razor blade between them, it may be held fast. The use of the handle makes the handling of the blade less dangerous.—FRED C. DAVIS.

A Lunch-Box Made from an Old Book

You will enjoy the contents of this volume

A LUNCH-BOX can be made from an old book of the proper thickness and size. With a straight-edge and an old safety-razor blade, the center of the pages are cut out as shown. When this is done, a thick preparation of glue is smeared around the inside and over this pieces of cardboard, cut to the proper size, are placed. When the glue sets, the book will stiffen up and a very good little lunch-box will be the result.

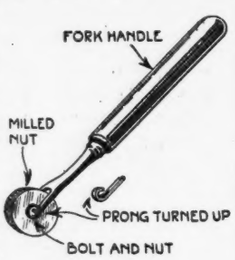
Some care and patience will have to be taken to see that the cutting is carried on as evenly as possible and keeping the pages uniform.—JOSEPH B. MORAN.

Protect Your Bank Account Against Forgers

THIS efficient check-protector may be made from an old table-fork and a milled nut. The nut should be wide enough to fit between the outer prongs of the fork near the shank. Now heat and cut off the fork prongs about 1 in. from the shank, and turn up the ends as shown.

If the nut be of a wide bore, insert a plug so as to reduce the bore to take a small ¼-in. bolt and nut.

This done, adjust the nut in place, pass the bolt through the fork ends and nut and tighten the bolt.—GEO. H. HOLDEN.



Run the wheel over the figures on the check

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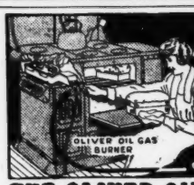

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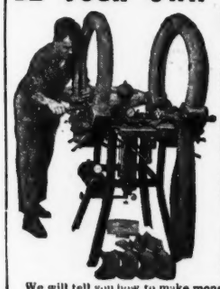

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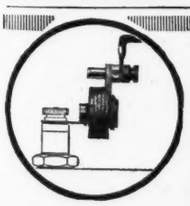

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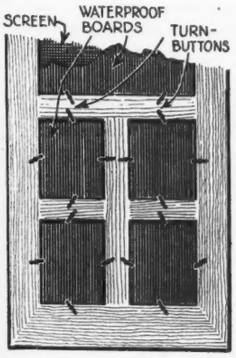
Panels in the Screen Door Make It Rainproof

AT a total expense of about one dollar a screen door can be converted into a weatherproof storm door, making it do duty twelve months a year. This may be accomplished with the aid of a sheet of waterproofed wallboard and a few accessories.

To convert your screen door into a storm door cut a sheet of wallboard, which can be obtained from any builder or mill at small cost, to fit exactly in the panels of the door. Place the boards tightly against the screen molding. This will make them level with the screen molding, and if they have been fitted carefully, they will make the door weatherproof.



Wallboard panels will make the screen door rainproof

Procure some turn-buttons, attaching them to the screen molding to hold the board in position.

Before placing the wallboard in position several coats of paint, of the same color as the door, should be applied, and if a small window is desired in the top panel, cut out a hole of the desired size and cover it with a pane of glass about an inch larger than hole. Take some cheap picture-molding, fit it around the glass and bolt it to the wallboard panel by means of several stove-bolts. In the spring simply remove the panels of wallboard and you have a screen door as before.—R. NEWBECKER.

How a Basket Became a Baby-Carriage

SHOWN in the illustration is a baby-carriage that was made from parts of an old folding baby-carriage, two boards, a few strips of wood, and an old clothes-basket. The construction of the carriage

Baby will sleep in this basket as well as in an expensive carriage

is clearly shown in the picture and requires no additional explanation. It may be stated, however, that the bassinet, though perhaps not very ornamental, was found to be perfectly safe and gave satisfaction to mother and baby.—PAUL J. KURTZ.

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Make Your Individual Drinking-Cup of Paper

OF a square piece of paper a drinking-cup may be made that will hold water and will be more sanitary than a public drinking-cup.

Fold the sheet of paper diagonally as shown in the diagram, then fold the two corners *A* and *B* along the dotted lines shown in Figs. 2 and 3 until the folded paper appears as shown in Fig. 4. Then turn the two flaps down on both sides and you will obtain the cup illustrated in Fig. 5.

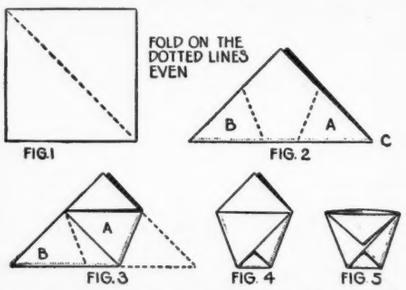


FIG. 1 FIG. 2 FIG. 3 FIG. 4 FIG. 5

Even an improvised paper cup is better and more sanitary than a public drinking-cup

If hard paper is used, the cup will hold water a long time.—F. EVERARD JORDAN.

Wiring Flower-Pots to the Porch Railing

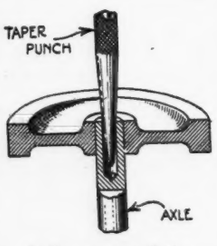
FLOWER-POTS can be secured to the railing of the porch or the window-sill as shown in the illustration. A staple is placed on each side of the pot and a wire is fastened to one staple, stretched over the top of the flower-pot, and then fastened to the other staple. Another wire is wound around the side of the pot and twisted around the first wire a few times where it crosses it. Both wires must be drawn as taut as possible, so as to hold the flower-pot firmly. The strongest wind will not blow the pot to the ground, and stray cats prowling around in the night will not knock it over.—ARTHUR GOLDENBAUM.

Wire the flower-pot and prevent accident

How to Fasten a Pulley on the End of a Shaft

I HAVE illustrated here a very practical method of placing a small pulley on a shaft.

A hole is first drilled in the shaft and the pulley put in position. The shaft is then spread out by inserting a tapered punch in the hole and hitting it a smart blow with a hammer. The taper on the punch should not be too small, as this would make it difficult to pull the punch out. —G. BENDER.



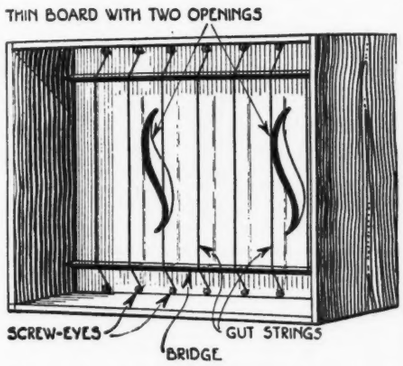
A few taps of the hammer will fasten the pulley

An Eolian Harp that Is Simply Constructed

THESE are rather pleasant things in the summer, as when the wind blows, they murmur and hum and sing.

If you wish to make an eolian harp, first decide where you are going to have it, whether in the open window, in place of one of the panes, or in a fanlight or ventilator opening; any opening that the wind has access to will do. Then make a wooden frame to fit. Make it fairly stiff with a top and bottom of hard wood; on to this frame glue a very thin sheet of wood having two openings in it, similar to those in a violin. This thin sheet must be flush with the outside of the window, so that the frame projects into the room.

Now get some screw-eyes and screw them halfway into the top and bottom of



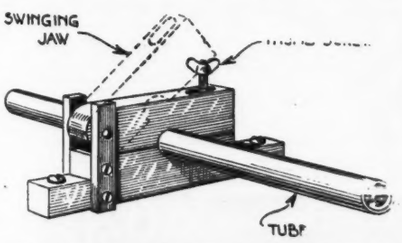
The wind and an eolian harp will entertain you with a continuous performance

the frame, close to the back. The number used is a matter of taste; the more strings there are, the louder the harp.

To these screw-eyes stretch gut strings, similar to those used for violins and banjos. Fasten them tightly and put two bridges under them of sufficient height so that the strain comes on the bridges, then screw up the eyes until you have sufficient tension; the tighter the strings the higher the note; they may be of various tensions or tuned to one note.—E. A. McCann.

This Vise Will Successfully Hold Small Tubing

SMALL tubing cannot be held in a heavy vise without danger of bending it. This little device, which is made of four pieces of cold rolled steel, will be found



Friction between pipe and blocks may be increased by tightening the thumb-screw

very practical for this purpose. The bottom piece has two projections so that it can be screwed to the bench. The hole in the top piece through which the bolt passes is of an oblong shape so that the piece can swing on its pivot. A winged nut is used to clamp the top piece down.

The tubing is inserted in the hole. If the mechanic wishes, he may make a vise with holes of different sizes.

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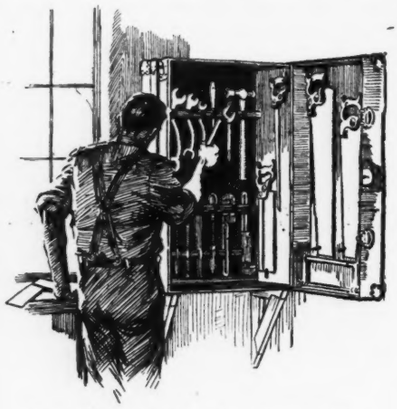
Old Trunk as a Tool-Chest for Wall

THE owner of a little shop has a number of tools that, because of their value, he wished to keep safe from dampness and the hands of those who visited the shop.

He fitted the top inside surface of an old



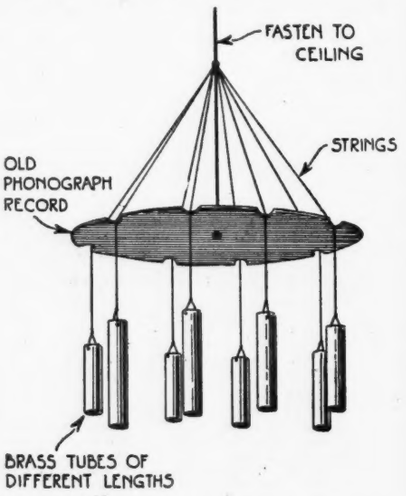
Careful mechanics who like to keep their tools in order will find this cabinet a great aid and protection

steamer-trunk as shown in the illustration, and screwed the bottom to the wall through two strips of wood.

The careful mechanic hangs his tools in the spaces provided and keeps them under lock and key when they are not in actual use.—CHARLES A. GODDARD.

How to Make a Set of Dinner Chimes

AN old phonograph record may be used in making a set of dinner chimes. Notches are cut as shown. There will be as many notches as there are tubes. A string is run from the center of the phono-



Home-made chimes like these, calling the family to meals, will add to the pleasure of the housekeeper and her family

graph record and several other strings branch off from this, each one holding a length of thin brass tubing. Notches cut in the edge of the disk prevent the strings from slipping. Holes are drilled through the top of the tubing to attach the string.

The tubes should be of different lengths so that different tones will be produced. A small piece of doweling may be used to strike the tubing.—JOSEPH B. MORAN.

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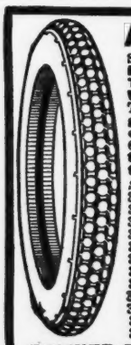

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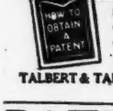

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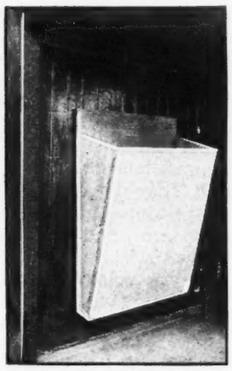
A Waste-Basket from a Cardboard Box

HOW a serviceable waste-basket can be made from an ordinary corrugated cardboard box in 15 or 20 minutes is illustrated here. Dimensions have not been shown as the size will be governed entirely by the requirements and material at hand.

A large and unbroken piece of cardboard is selected and cut out and folded as shown. If a single piece of sufficient size is not at hand, two pieces can be used just as well. After the cardboard is cut and folded, gummed strips are pasted along the edges. The waste-basket will then be ready for service. It may be suspended from hooks or fastened with a thumbtack.

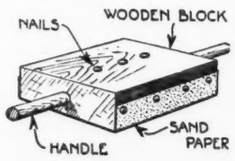


This waste-basket may be suspended under the desk

This type of waste-basket takes up little room and will fit into a much smaller space than the usual type.

Sandpapering Rendered Easy with This Block

THE writer had a big surface to sandpaper and the use of an ordinary block of wood proved very unsatisfactory. He hit upon the idea of providing his block with handles.



Use a block like this in sandpapering

A hole was drilled through the block. A short length of broom-handle was then placed in the hole. Three nails were then driven into the top of the block down through the handle. This held the handle tightly in place.

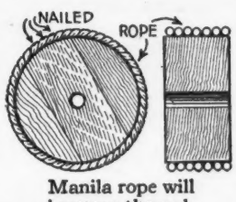
With the aid of the handle considerable pressure can be brought to bear on the surface and the hands never slip off.

To Increase the Diameter of a Pulley

THE diameter of a wooden pulley can be made larger in the following manner:

Wind a length of manilla rope around its circumference in a spiral, pressing the strands close together. The end of the first turn should be nailed to the pulley, as should some point in each succeeding turn. Pull each turn of rope as tight as possible to eliminate play and subsequent stretching. The last turn should also be nailed.

This treatment will increase the diameter of the pulley to double the diameter of the rope.



Manila rope will increase the pulley's diameter

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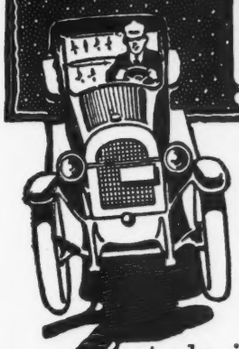

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Gesso-Work Is Not Difficult to Learn

By E. A. McCann

GESSO is the composition of which framemakers model the fancy scroll-work and such like on to their moldings.

To make it, heat some ordinary glue in a double vessel. The regular glue-pot is the best, but two cans, one inside the other will do, the outer filled with water and kept boiling, until the glue in the inner can, mixed with a little water, is melted. Into the thin glue stir whitening finely powdered until the mixture has the consistency of putty.

With this composition all kinds of ornamental relief work can be put on picture-frames, mirror-frames, panels, fancy key-holes, etc.

Suppose you are going to make a picture-frame after your own design. Get a wooden frame for a base; hard wood or three-ply are the best because they are not so liable to warp. Draw or trace your pattern on the frame, mix the composition, and lay it on, keeping it warm all the time. Use a little at a time, and apply and model it with such tools as come to hand; a pen-knife, a putty-knife, an artist's paint-brush, and wooden spatulas are all useful. A small lance-wood modeling-tool as shown here is very handy and can be bought at an art shop. Keep your tools lightly oiled so that they do not stick to the gesso.

If one pattern, such as a flower, is to be repeated often, you may make a mold by carving it from wood or molding it in gesso (in reverse), allowing it to harden and keeping it well oiled. Place a bit of your soft gesso in the right place and press it into shape with your mold, cutting away all waste. Considerable pressure will be required. For that reason make the mold big enough to get a firm hold of it. Mark lines on the edges to show where the center is.

If you are going to make a high relief, put some small screws in the wood at the highest point; they stop the gesso from breaking off if the work should get knocked about.

There is no limit to the kind of design that can be selected, formal, flowers, figures, landscape or whatever your skill and fancy suggest.

Furniture, such as chests of drawers, cupboards, and cabinets, is sometimes improved with panels and borders of this work, especially that which is enameled. The enamel should be scraped off the place you are going to decorate.

If making a Florentine pattern, cut out the holes through the wood with a fretsaw before applying the gesso.

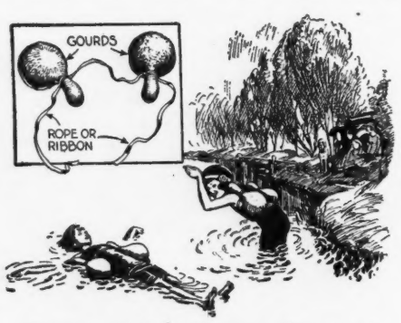
For coloring use ordinary oil-paints and gold and silver paint or leaf.

Darker colors in the hollows will make the modeling stand out in stronger relief.

Modeling in gesso is a pleasant pastime for the amateur endowed with artistic talent

Two Gourds Furnish One Life-Preserver

USUALLY "water-wings," the beginner's swimming aid, are made of closely woven cloth, which, when soaked with water, will retain a quantity of air. Although this amount of air is sufficient to hold a person of ordinary weight on the surface of the water, the wings, by reason of their porosity, quickly collapse, requiring frequent inflation.



Two gourds tied with tape will support a person of average weight in the water

A pair of fair sized gourds will be found to answer the purpose of water-wings admirably. They require no inflation and will not become water soaked. The two gourds are simply connected by fastening the ends of a light rope or strong ribbon to each gourd. The would-be swimmer then places the rope under his or her armpits as shown.

The rope or ribbon may be left long so that the gourds can be fastened to the swimmer like a life-preserver. This will give the beginner added confidence.

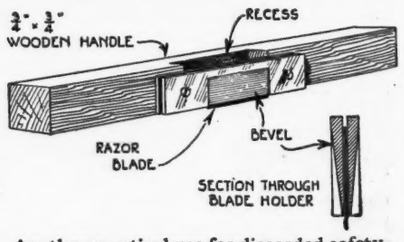
Emergency Spokeshave from a Razor-Blade

AN excellent emergency spokeshave suitable for light work can be constructed from an old safety-razor blade.

First cut two plates 2¼ in. long by ½ in. wide, beveling both plates on one edge, and drilling each end for fixing screws.

Then take a piece of wood about 9 in. long by ¾ in. square, and cut out a slot about 1 in. long in the center.

Now insert the razor-blade between the two prepared plates, adjust so that the cutting edge protrudes about 1/16 in., and screw into position as shown.



Another practical use for discarded safety-razor blades is illustrated in this tool

A Homemade Scraper for the Lawn

IF a lawn is to be leveled, this homemade scraper will be found very useful. Two large blocks of wood about 6 in. thick and 5 ft. long, are held together with two iron rods threaded at each end. Holes are drilled in the heavy wooden pieces to accommodate the rods. The rods are inserted in place and the nuts screwed down tight.

Farmers and suburbanites can make the scraper shown here with little effort

Two boards are then nailed across the top and an old wagon seat is placed on them. A chain is fastened to the front end of the two bolts and a whiffle-tree is attached to it if the scraper is to be pulled by horses, but it may also be used with a tractor.—G. BENDER.

You Can Enjoy Cool Breezes without Catching Cold

ONE of the most delicious and certain ways to catch cold in warm weather is to sit in a cooling breeze when one is very warm.

Here is a way in which to get comfortably and safely cool without the risk of catching cold: The necessary apparatus is an easy chair, an electric fan with the current to run it, a dish on which is a piece of ice, and a screen. For the latter, a piece of fairly thick cardboard will do. These should be arranged in a position well above the head of the sitter, in this instance on the top of an upright piano. The fan should be so placed as to blow the air current directly on the ice but not on a line with any person. The screen should be just back of the piece of ice at an angle of about 45 degrees so that the cool air current on striking it will be deflected toward the ceiling. This will cool the hot air that is always to be found near the ceiling of the room. The screen should be so arranged laterally that the sitter gets the benefit of the cooled air from the ice without having it blown directly upon him.—W. T. PERRY.

By using this arrangement you may enjoy a cool breeze without being in a draft

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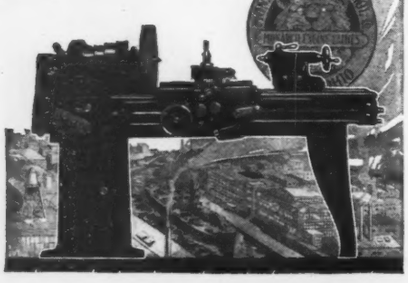
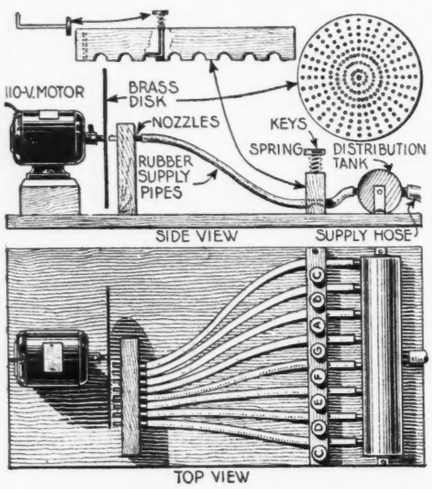


To Build an Electric Calliope

By L. A. Laurier

BUILDING an electric calliope is simple, and the materials, aside from the electric motor, are quite inexpensive. The motor driving the device must be of the 110-volt style, some small fraction of a horsepower.

If a perforated disk is traveling at high speed and a jet of air is directed against the perforations, a shrill whistle will be produced, providing the disk is traveling fast enough and the air is at high enough pressure. The frequency or the pitch of the note produced will depend entirely upon the speed of the disk and the number of the holes. The disk shown here has eight rows of holes arranged concentrically representing the notes of an octave.



Tunes played on this electrically driven siren can be heard a mile away

Eight separate nozzles are arranged so that the air flowing through each will be directed against one of the rows of holes. The rubber tubes leading to these nozzles are normally closed, but they may be opened by the set of keys ranging from C to C, as shown on the keyboard. When the motor is in rotation and compressed air is forced into the distributing tank, the various notes may be sounded by pressing the corresponding key. In this way simple music can be played.

The motor used must be mounted upon a wooden block so that its axle may carry a disk large enough to accommodate the eight concentric circles of holes.

The brass disk is soldered to the motor-shaft. It is necessary that this should run fairly true. It may be necessary to solder a little collar on the shaft of the motor. The 1/32-in. brass disk should be cut from a perfectly flat piece of brass.

When the piece is cut out, it will be necessary to scratch eight concentric circles upon it with a pair of dividers. One-eighth-inch holes should be drilled around these circles. They should be about ⅛ in. apart.

After the disk is drilled, it should be fastened to the surface of a flat piece of wood with a few tacks. It should then be brought in contact with a lap grinder to take off the burrs. Each side of the disk is treated in this way.

The eight little brass nozzles required should be made from ⅛-in. brass tubing and one end should be made slightly smaller than the other. A block of wood is now cut and eight holes are drilled in this to receive the eight brass nozzles. The holes drilled should be slightly smaller than the tubes so that the tubes will fit snugly. The block carrying the tubes is placed on one side of the disk as shown. It is held there by two screws that pass up from beneath.

The details of the keyboard will be ascertained by a careful study of the drawing.

The details of the key seats and of the keys are also clearly shown. The key rods can be made of small brass rod. They are bent at one end and threaded at the opposite end to receive the key plate. After the key rod has been put in place, an expansion spring is slipped over the rod, before the key top is screwed in place. The keyboard is assembled and put in place across the base of the instrument. Eight rubber tubes similar to those used by chemists are slipped over the eight nozzles and under the keyboard. They run from the keyboard to a distributing tank.

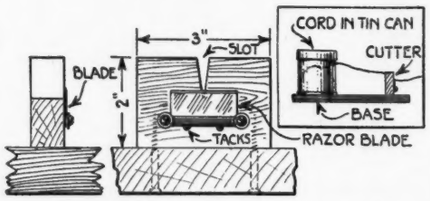
The distributing tank is really a piece of heavy brass tubing about 1½ in. in diameter with the ends soldered in place. This is provided with eight little nozzles to which the rubber tubes are attached. The rubber tubes should fit snugly over the nozzle so that no serious leakage will occur. The distributing tank is held to the base of the instrument by two little angle pieces. The back of the tank has a larger nozzle that is made to accommodate a large hose that runs to the source of compressed air.

For a supply of air the writer used a small hot-water boiler. Pressure was produced in this by an old single-cylinder gas engine reconstructed to act as a compressor. This was driven by gasoline motor, although an electric motor could have been used.

Cord-Holder and -Cutter for the Home

THOSE who are frequently called upon to tie up parcels will find the cord-holder and -cutter described here a valuable addition to domestic time and labor savers.

A ⅞-in. board, 6 in. by 10 in., forms the foundation. A cylindrical tin can of 5 in. diameter and 6 in. high is nailed to the board with small nails driven through the bottom of the can. It serves as the holder for the ball of cord. The cover on the can protects the ball from dust and dirt. The cord passes from the ball, through a small hole punched in the side of the can, to the cutter. This consists of a small block of wood 2 in. by 3 in. in size and ¾ in. thick. A V-shaped cut, ⅞ in. deep, is made in the block as shown in the illustration and a safety-razor blade is fastened against the side of the block by screws and washers so that the edge extends ⅛ in. or more above the bottom of the V. The cord is cut by the sharp edge of the razor.—P. P. AVERY.



Wherever many bundles have to be tied, one of these homemade twine-holders and -cutters should be used

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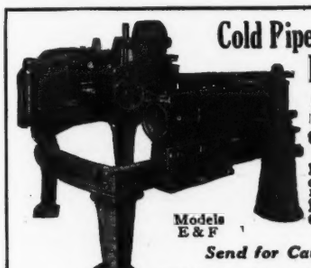

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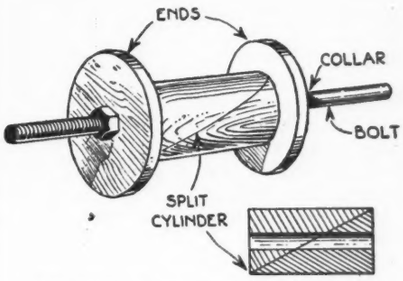
A Coil-Winding Mandrel with Removable Core

WHEN coils are to be wound for dynamos or other electrical apparatus, the little mandrel or winding jig shown will prove very useful.

A wooden block is turned into a cylinder on the lathe. The diameter of this cylinder should correspond with the internal diameter of the coil to be produced. The

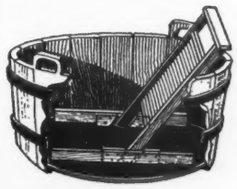


After the winding of the wire is completed, the spool is taken off the bolt and the split mandrel removed

center of the cylinder is bored out so that it will just fit over the bolt. Two end pieces are then cut. Before assembling the device the spool is split in half at an angle with a saw. When the coil is wound, this will make it possible to take the spool out without any trouble. The bolt is mounted in the chuck of the lathe while the coil is being wound.—W. C. ROYER.

For Holding the Washboard in Place

HOUSEWIVES often find it difficult to keep the washboard properly placed in the tub when doing a light washing. The legs of the board slide on the bottom of the tub until they rest against the far edge of the bottom, which usually makes the board too low.



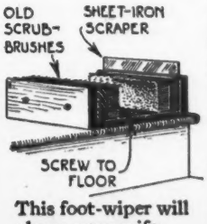
Keep the washboard from slipping

This may be easily overcome by cutting two light wood strips 2 in. wide and 1 in. thick, long enough to fit snugly into the bottom of the tub when the legs of the board have been placed between them.

Cleats on both sides hold the board at the proper angle.

Two Scrub-Brushes Will Make a Foot-Wiper

VERY practical is this foot-wiper for use on the back porch. It can be made from two scrubbing-brushes. These are mounted, as shown, on two boards. The boards are held in an upright position by a base that is firmly screwed to the floor of the porch.



This foot-wiper will please your wife

A piece of heavy sheet iron screwed to the side piece will act as a scraper.—MATTHEW POTTS.

Here is an instrument for counting anything from number of people at'ending a ball game to number of packages in an inventory — the

Veeder HAND TALLY

With quick set-back

In the public place it counts *persons;* in the factory or store it counts *stock;* "in the open" it may count anything from cattle on a ranch to poles on a telephone line!

Registers one for each pressure of the thumb-lever, counting up to 10,000, then repeating. Can be set back to zero from any figure by turning knob on right of instrument *once around.* The finger ring is so located as to permit using counter in either hand. The corners of the case are rounded so as not to irritate the hand of the user, or wear the pocket if carried. The size, exclusive of finger ring, is 2 inches greatest diameter. Price, $5.00.

The Veeder counter catalog shows Production Counters and Speed Counters, along with the Hand Tally. Ask for copy when writing.

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Use them on other doors, too. There is the coat closet in the front hall, the downstairs lavatory door, the bathroom door, the pantry door, the kitchen door, the basement door and others.

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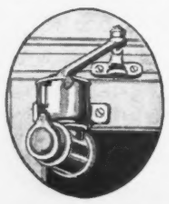

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On Collecting and Mounting Butterflies

Patience and care insure success

By E. Bade

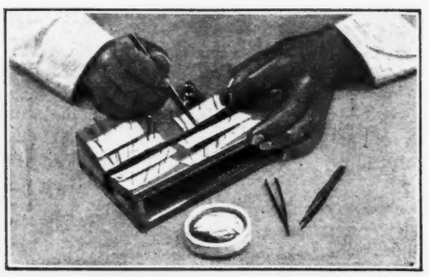
NEXT to a net, the most essential requisite of a butterfly-collector is collecting glasses into which the specimens are thrust. These are bottles having wide mouths and usually containing cyanide of potassium, which kills the butterflies quickly and painlessly. But young collectors should not be entrusted with this violent poison. Chloroform, ether, tobacco juice, or benzine are some of the less deadly poisons.

By mounting butterflies under glass and frame a handsome serving-tray can be made

The butterflies must be spread on a board and dried before they are mounted.

The spreading-board consists of two thin strips of wood so placed on a base that they gently slope toward the center. This slope prevents the wings of the butterfly from sinking too much when the process has been completed. Between the two sloping strips of wood, a small rill or opening is left that is just large enough to receive the body of the insect.

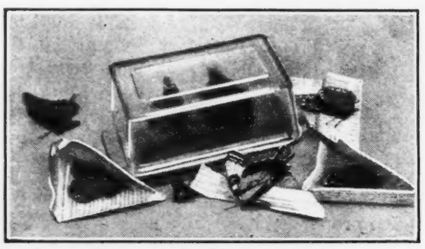
A very thin japanned black pin is thrust two thirds through the body so that the joints of the legs are neither severed nor pierced. The insect is now pinned to the spreading-board so that the base of the wings are even with both sides of the board. Then, with paper and pins, the wings are spread as indicated by the accompanying illustrations, care being taken not to puncture them with pinholes nor to give them an unnatural position.



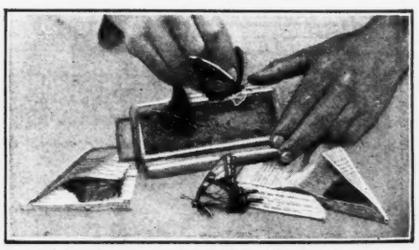
Here the dead butterfly is shown on the spreading-board

On extended trips it is often impossible to mount butterflies after they have been killed, therefore small rectangular pieces of newspaper are used to make paper bags as containers for them. A number of such paper bags can be placed in a tin box for safe transportation. To prevent the destruction of these insects by moths, a layer of camphor should be placed between each row. Preserved in this manner they will keep indefinitely. But before spreading these dried specimens, they must be made pliable and soft. To accomplish this the specimens are placed in a dish containing moist sand. After a few hours, if the dish has been fitted with a tightly fitting cover, the butterflies will be sufficiently soft so that they can be placed on the spreading-board.

Butterflies are collected for various purposes. It is as a decorative medium, though, that the beautiful creature really excels. The first illustration in this article shows its possibilities as a decoration for a serving tray, and there are articles of personal adornment, such as pendants and brooches, for which it can be used.



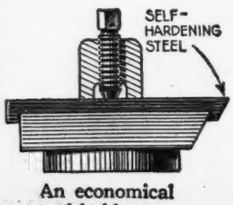
Butterflies too dry for spreading may be softened in a dish of moist sand tightly covered



This shows how to handle and pack specimens. Fold in paper and place in a tin box

An Economical Homemade Tool-Holder

HERE is a tool-holder of my own make that I have successfully used in machine-shops. Anybody or any shop with a milling machine can easily make them. Mill a suitable groove in the upper edge of tool-steel stock (unhardened), which should be about ½ in. to ⅝ in. thick. The groove should be of such width that the self-hardening steel will fit into the groove snugly. I use 5/16-in. square self-hardening steel and set it into steel stock ½ in. by 1 in. in section.



An economical tool-holder

The chief value of this arrangement is that a long piece of self-hardening steel may be used first and ground down more than half its length before it need be discarded. The discarded piece can then be used in other tool-holders of standard make until so short that it can no longer be used.—W. F. SCHAPHORST.

Catch and Collect the Dew in a Pond

THE principle on which the dew pond works is the complete insulation of a water-containing surface from the surrounding earth. To make a dew pond, dig an excavation at least 1 ft. deep and some 6 ft. square; in this place a thick layer of perfectly dry straw and over it a layer of puddled clay; on this a close layer of small

In a dry, hot summer dew-ponds will add to your water supply

stones. See that the clay comes well over the edge, to prevent any water reaching the straw underneath.

During the day the ground round about will store up heat, and consequently water will not condense on it, but the ground under your pond is insulated from the sun's rays and remains cool; this is aided by evaporation of moisture from the puddled clay.

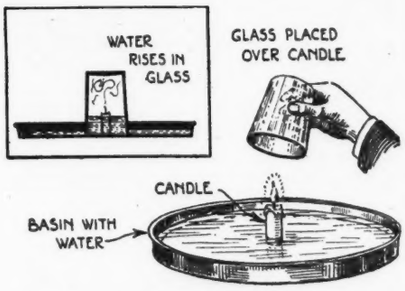
At night, consequently, there will be a heavy condensation of moisture from the warm air, much greater than the evaporation during the day; this will gradually fill the pond, even in the hottest weather.

The pond should be protected from cattle, as their feet would soon ruin the clay bottom.

This plan has been used with success in high-lying waterless districts and where the water supply is far from the house or the troughs.—E. A. McCann.

Children Will Appreciate This Parlor Trick

FOLLOWING is a little parlor trick that will interest the children. A little water is placed in the bottom of a pie-tin or deep dish. A candle is placed in the center of the dish and lighted. When a tumbler is



When you show this trick to your children, do not fail to explain the principle of it to them

placed over the lighted candle, the candle will go out and part of the water in the bottom of the pan will rush up into the glass. This is caused by the candle using up the oxygen inside of the glass, which creates a partial vacuum.—J. B. Moran.

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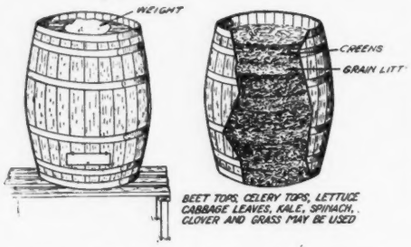
Barrel Silo Preserves Feed for Poultry

SUPPLYING green feed for laying fowls in winter has always been more or less of a problem with poultry-raisers. The practice of gathering greens during the open season and drying them for winter use has been successful, and is recommended as a good poultry procedure.

To those, however, who seek a green ration approximating a natural state, a poultry silo is suggested for trial. It can be constructed of the same material that is used in making silos for cattle—old whisky, molasses, or vinegar barrels or hogsheads may be used. The smaller containers are recommended as more convenient where fowls are kept in pens—one barrel for each pen.



Now is the time to lay in a store of green feed for the fowls in winter: try this method

The illustration shows the construction of the barrel type. For convenience, the barrel or hogshead is placed upon a stand made of heavy boards, at a height of about 12 in. from the ground. The boards composing the floor of the stand on which the container rests should be several inches apart so that air can circulate freely. Also a hole should be bored in the bottom of the barrel to drain off excess liquid. The top or head of the barrel should be of such size as to fit in the barrel and be easily removed, and a weight should be placed upon it to pack down the contents. Six inches above the base of the barrel an opening may be made for access to the silage. The lid or flap of this opening should fit snugly and be secured in place by a wooden or iron button.

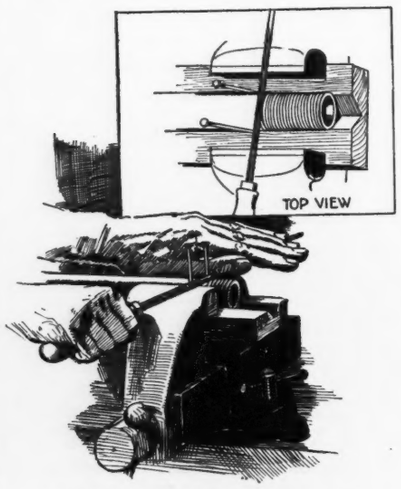
The green feed to be stored may consist of beet tops, lettuce and cabbage leaves, celery tops, kale, spinach, clover, and succulent grass from the lawn or roadside—any greenstuff that is fed to chickens. For convenience in feeding, it is advisable to chop this material fine. The silo may be filled at one time, or partly filled, and the contents added to as opportunity arises.

The cross section pictured gives an idea of the contents of the barrel or hogshead, showing the layers of different greens. In this connection it may be mentioned that between these layers, litter from the barn floor—usually containing grain—may be used. It has a tendency to absorb superfluous juices.

Thread-Cutting Can Be Done without a Die

SOMETIMES it happens that one wants to cut a thread in a pipe, but has not a die of the right size.

Under such circumstances, cut a V-shaped groove in a block of wood and put it in the vise so that the round of the pipe lying in it will just project above the top of the jaws. If it is a long pipe, it is necessary that the far end should also be supported.



Following the directions here given you may thread a pipe without a die

On this bed lay a piece of pipe with a thread similar to the one you want to cut; place a half-round file in the thread at exactly the same angle and drive a nail at each side of the pipe, just touching the flat side of the file.

Replace this pipe with the one to be threaded and cut your thread with the file, keeping the flat side lightly against the nails and the pipe turning with a backward and forward movement so as to cut evenly.

The nails, of course, should be long enough to project well above the pipe so that the file will rest against the body of the nail and not against its head.—E. A. McCann.

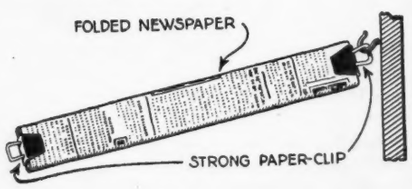
Improvise a Razor-Strop from a Newspaper

FOLD a newspaper several times into a long thin pad, and you will have a good emergency razor-strop that cost nothing.

When the paper is folded to the size of a leather strop, attach a strong paper-clip to one end so that it may be hung from a nail or hook. It is used in precisely the same manner as you would use a strop made of leather.

Printer's ink provides an excellent stropping agent, and the steel will be found to bite after the first few sweeps of the blade.

When the ink is worn off from the top layer of paper, turn the outer covers to the inside and the strop will last another month without the necessity of refolding.—George H. Holden.

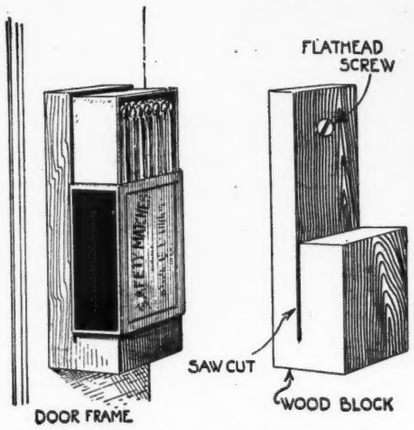


A strop made from a folded newspaper will produce a keen and smooth edge on your razor

Matchbox-Holder from a Block of Wood

A SERVICEABLE matchbox holder can be made from a block of wood 3 in. long and 1¼ in. square at each end. Two cuts are made as shown in the picture on the right. By these cuts a rectangular piece of wood is cut out of the original block.

The complete holder, before the match-box is put on, is shown on the right. Only the safety-match type of box can be used with this holder.



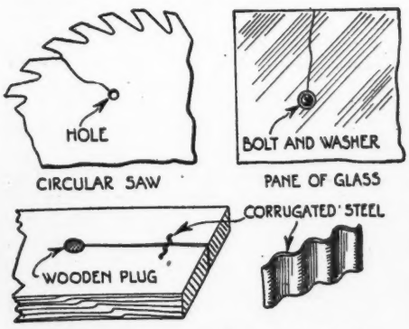
Two cuts of the saw will change the block to a convenient matchbox-holder

The small inside tray that contains the matches is slipped out of the box-cover, and the empty cover is put on the holder, as shown on the right. The holder can be varnished to harmonize with its surroundings.

Several Methods of Stopping a Crack

TO mend a crack in a circular saw drill a small hole at the end of the crack, being careful that the crack does not extend beyond the hole.

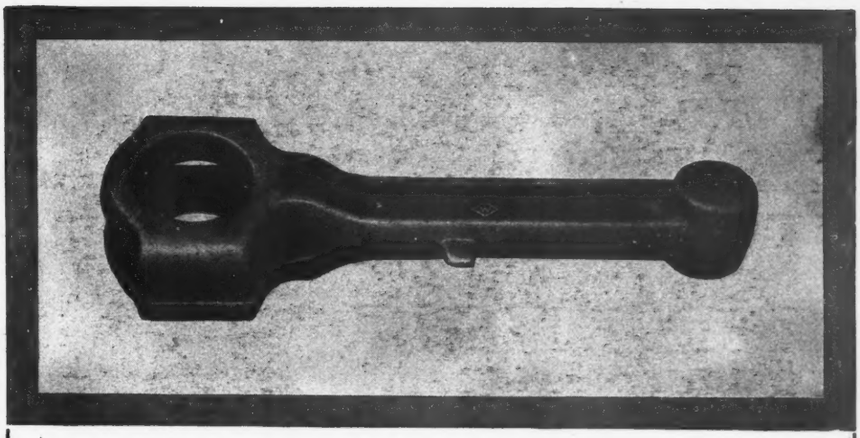
Do the same for a crack in a pane of glass, but get two rubber washers and with a small nut and bolt through the hole screw them on to the glass. In a piece of thin glass, a cross scratch just beyond the crack will be sufficient to prevent its running.



Several efficient methods of stopping cracks in different materials are here illustrated

For a crack in a piece of wood, bore a hole just beyond the crack and fill with a plug (not too tight) well glued and cut level.

Box-nails are very valuable for keeping cracks drawn together or for stopping their extending. They are small, corrugated pieces of steel, sharp at one edge, and are driven across the grain.



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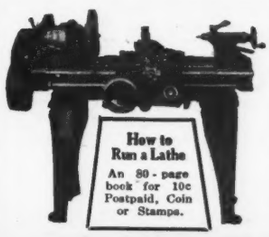

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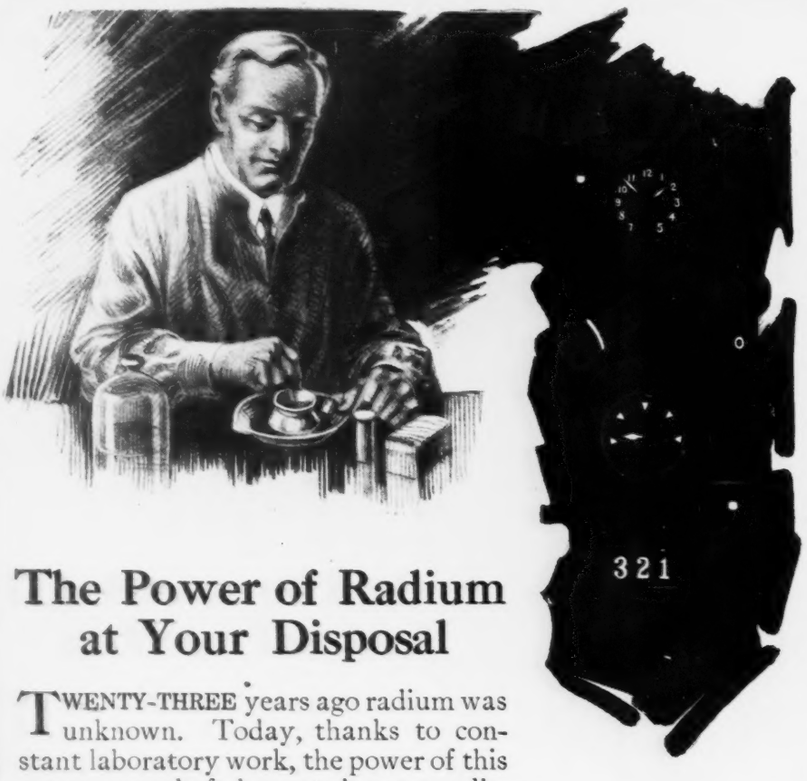

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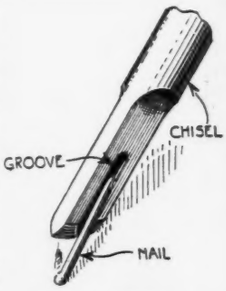
A Tool that Will Remove Clinched Nails

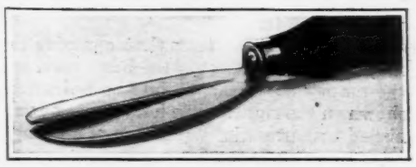
CLINCHED nails are very hard to remove with an ordinary claw-hammer. With little trouble an old cold chisel may be used for this purpose. A groove is ground in the chisel as shown. The chisel point is placed at the point of the nail with the point of the nail at the bottom of the groove. If the chisel is hit a good blow, it will sink into the wood, lifting the nail point at the same time. The nail point will remain in the groove and if the chisel is hit several blows, the nail will become straight.—JOSEPH B. MORAN.



For straightening clinched nails

Would You Like a Pointless Letter-Opener?

THIS letter-opener without a point consists of two overlapping blades, as shown in the illustration, made from stiff tin or copper, and fastened to a handle.



You cannot hurt yourself with this letter-opener; it has no sharp point or edge

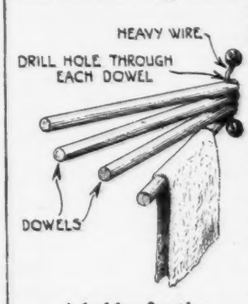
The shapes of the blades may be varied, but the blades always overlap.

In use, the lower blade is inserted between the letter and the flap and the envelope cut open in the ordinary way. This tool has no points, and the sharp edges are fully protected, so that injury with one of these openers is virtually impossible.—FRED C. DAVIS.

Construct a Towel-Rack for the Kitchen

MADE of a piece of stout wire and three or four ¼-in. dowel-sticks, this towel-rack is inexpensive to make. One end of the wire is bent in a loop as shown in the drawing. A small hole, a little larger than the wire, is bored through each dowel-stick about ¼ in from the end. The wire is then put through the holes in the sticks and another loop made in the other end of the wire. The loops should be made small enough so that a screw will fit through them.

The holder is fastened to the wall or panel by screws put through the loops. The sticks can be sandpapered and painted to match the woodwork.—ARTHUR GOLDENBAUM.



A holder for the kitchen or bathroom